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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 13, NUMBER 6
MARCH 15, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
Office of Water Research and Technology
U.S. Department of the Interior

VOLUME 13, NUMBER 6
MARCH 15, 1980

W80-02001 – W80-02400

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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07 RESOURCES DATA

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

GEOTHERMAL SPACE HEATING/COOLING--A DIRECT USE OF NATURALLY OCCURRING HOT WATER IN SOUTHERN ARIZONA,
Arizona State Bureau of Geology and Mineral Technology, Tucson.
J. C. Witcher.
Fieldnotes, Vol 9, No 4, p 1-2, December 1979, 1 Fig, 4 Ref.

Descriptors: *Geothermal studies, *Absorption, *Refrigeration, Thermal water, Arizona, Cooling water, Air conditioning, Heating.

The maximum efficient use of the significant geothermal reserves believed to exist in Southern Arizona can be achieved, under proper circumstances, by the utilization of hot water to cool areas of human occupancy. This apparent paradox of using heat to make cold is possible by the not so new technology of absorption refrigeration. Useful also to freeze and preserve food, a geothermal absorption system simply substitutes hot water for the gas or electrically-produced heat used in conventional absorption units. The operation of an ammonia and water absorption refrigeration unit is described here while explaining that water and lithium bromide may also be used in a low pressured process. The use of geothermal space cooling is still under investigation by the Arizona Bureau of Geology and Mineral Technology and will depend upon the location, temperature, production rates, and chemical quality of hot water in Arizona's potential geothermal reservoirs. (Tickes-Arizona)
W80-02204

1B. Aqueous Solutions and Suspensions

INVESTIGATION OF INTERMOLECULAR ASSOCIATION IN CONCENTRATED SOLUTIONS OF CELLULOSE ACETATE,
Carnegie-Mellon Univ., Pittsburg, PA. Dept. of Chemistry.
G. C. Berry, T. S. Sham, and M. A. Leech.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124670, Price codes: A04 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology (1979) 63 p, 16 Fig, 5 Tab, Append. OWRT S-0012 (No 7528) (1), 14-34-0001-7528.

Descriptors: *Reverse osmosis, *Semipermeable membranes, *Aqueous solutions, Cellulose, Solvents, Chemical reactions, *Cellulose triacetate, Intermolecular association, Rheological properties.

The role of intermolecular association in concentrated solutions of cellulose triacetate (CTA) is investigated with respect to its importance in controlling the properties of CTA films formed from concentrated solutions for use, for example, as membranes in desalination by the reverse osmosis technique. The studies reveal the presence of extensive intermolecular association of CTA, even in very dilute solutions. The data also reveal that CTA has a larger unperturbed dimension than secondary cellulose diacetate. Rheological data obtained on some moderately concentrated solutions also exhibit the effects of interchain association. It appears that association leads to the formation of loci of imperfectly ordered domains that at as crosslinks, forming a type of randomly branched structure. This extent of this structure may control the properties of films formed from such solutions.
W80-02297

INVESTIGATIONS ON POPULATION DYNAMICS OF WATER BEETLES OF TWO SWAMPS IN THE NORTHERN AREA OF THE BLACK FOREST. POPULATIONSDYNAMISCHE UNTERSUCHUNGEN AN WASSERKAFERN ZWEIER HOCHMOORE DES NORDSCHWARTZWALDES,
Stuttgart Univ. (Germany, F. R.). Zoologisches Inst.
V. K. Dettner.
Archiv fur Hydrobiologie, Vol 77, No 3, p 375-402, Mai, 1976. 11 Fig, 5 Tab, 45 Ref. (Summary in English).

Descriptors: *Aquatic insects, *Water beetles, *Swamps, *Ecological distributions, Wetlands, Hydrogen ion concentration, Ecology, Insects, Aquatic animals, Invertebrates, Germany.

The relative abundances and frequencies of 39 species of water beetles were examined in small water areas in two swamps in the northern areas of the Blackforest. In contrast to the Palpicornia, three representatives of the Hydradephaga show correlations between their dominances and abiotic factors: Agabus sturmi prefers water with a high pH; A. melanarius prefers water with a high level of humic-acids; Hydroporus tristis prefers water with a low hardness. Marking experiments with three beetle species capable of flight indicate that A. melanarius and A. sturmi are relatively stationary; Hydrobius fuscipes is not. The results of qualitative samples show that small waters within these swamps are marked by a constant inventory of species. (Stihler-Mass)
W80-02308

2. WATER CYCLE

2A. General

RECYCLING OF WATER IN THE AMAZON BASIN: AN ISOTOPIC STUDY,
Comissao Nacional de Energia Nuclear, Sao Paulo (Brazil).
E. Salati, A. Dall'Olio, E. Matsui, and J. R. Gat.
Water Resources Research, Vol 15, No 5, p 1250-1258, October 1979. 5 Fig, 19 Ref.

Descriptors: *Hydrologic cycle, *Precipitation(Atmospheric), *Evaporation, *Isotopic studies, *South America, Rainfall, Rivers, Sampling, Oxygen isotopes, Data processing, Regression analysis, Clouds, Weather, Meteorology, Tropical regions, Watersheds(Basins), *Brazil, *Amazon Basin.

The oxygen-18 content of precipitation in the Amazon basin is characterized by a very small inland gradient, 0.00075 parts per thousand/km. This is a consequence of the large contribution of reevaporated moisture to the basin's water balance. A distinct seasonal and regional pattern of stable isotope composition has been recognized and shows the basin to be inhomogeneous from the hydrometeorological point of view. The occasional appearance of very low delta values is believed to be related to the position of the ITCZ rather than to interbasin processes. (Sims-ISWS)
W80-02181

EVIDENCE OF ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINELANDS,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 5B.
W80-02190

A CLIMATIC DELINEATION OF THE 'REAL' CHIHUAHUAN DESERT,
Texas Univ. at El Paso. Dept. of Geological Sciences.
R. H. Schmidt, Jr.
Journal of Arid Environments, Vol 2, No 3, p 243-250, 1979. 15 Fig, 31 Ref.

Descriptors: *Climatology, *Weather data, *Chihuahuan Desert, *Arid lands, *Mapping, Temperature, Precipitation(Atmospheric), Martonne index of ardity, Mexico, Southwest US.

The intent of the present study is to provide an improved regional map of the Chihuahuan Desert based upon a more uniform, consistent and comprehensive system than has been available in the past. Mean annual temperatures and precipitation values are obtained for nearly 800 weather stations in the states of Arizona, New Mexico, Texas, Sonora, Chihuahua, Coshuila, Durango, Zacatecas, San Luis Potosi, Nuevo Leon and Tamaulipas, and classified according to the 1926 Martonne Index of Aridity. Based on an aridity index of < or = to 10 it is indicated that the Chihuahuan Desert covers approximately 350,000 sq km, including 115 weather stations, and possesses striking homogeneity. The mean average indices were found to be 7.9 with mean and median annual temperatues of approximately 18.6C and average annual precipitation of 235 mm. Twelve other delineations of this desert area are mapped here at the same scale due to existence of large areas where data is not available and to make possible a comparison and provide additional basis for the establishment of firm boundaries. (Tickes-Arizona)
W80-02207

WATER RESOURCES OF THE CHEHALIS INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
H. E. Pearson, and G. T. Higgins.
Geological Survey open-file report 77-704, 1979. 56 p, 7 Fig, 2 Plates, 13 Tab, 20 Ref.

Descriptors: *Water resources, *Surface waters, *Groundwater resources, *Water quality, Aquifers, Water wells, Water yield, Water level fluctuations, Lakes, Streamflow, Storm runoff, Floods, Peak discharge, Low flow, Flow rates, Flood frequency, Historic floods, Maximum probable flood, Stage-discharge relations, Washington, *Chehalis Indian Reservation.

Ground water beneath the 6.6-square-mile Chehalis Indian Reservation, Wash., most of which lies on a flood plain, occurs in the alluvial and terrace sand and gravel deposits. Supplies available within the depth zone of water-level fluctuations are estimated to be between 20 and 60 times that being pumped at the time of the 1975 study. Seasonal water-level changes in wells obtained during the study ranged between about 3 and 10 feet and averaged 7 feet, and the average fluctuation of water levels in three oxbow lakes was about 6 feet. Chemical analysis of ground water shows it is suitable for most uses and that to date there are no serious problems of ground-water pollution. Surface-water quality also is considered generally good. Flooding of reservation land by the Chehalis and Black Rivers occurs annually, generally during periods of heavy rainfall in winter. The largest known flood of the Chehalis River, recorded on January 22, 1972, had an estimated discharge of 53,000 cubic feet per second. Flood-frequency analysis indicates that about 70 percent of the reservation would be flooded during a 50-year flood. Low flows generally occur in August and September. The lowest flow of Willamette Creek (the only stream entirely on the reservation) during 1975 was about 0.45 cubic foot per second, recorded in August. (Woodard-USGS).
W80-02242

HURST PHENOMENON AS A PRE-ASYMPTOTIC BEHAVIOR,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. D. Salas, D. C. Boes, V. Yevjevich, and G. G. S. Pegram.
Journal of Hydrology, Vol 44, No 1/2, p 1-15, November 1979. 7 Fig, 3 Tab, 32 Ref. NSF ENG-1736, ENG77-26729.

Descriptors: *Hydrology, *Hydrologic aspects, *Statistical methods, *Stochastic processes, Analytical techniques, Mathematical models, Analysis, Statistical models, Time series analysis, Model studies, Statistics, Simulation analysis, Distribution, Hurst phenomenon.

Interpretation of the Hurst phenomenon has been controversial in statistical hydrology ever since the Hurst publication indicating that the expected rescaled adjusted range of certain geophysical time series apparently does not behave as n to the 0.5 power. One interpretation has been that the expected rescaled range is asymptotically proportion-

al to n to the h power with h greater than 0.50. Another interpretation is that series exhibiting this phenomenon have Hurst slope h greater than 0.50 for small or moderate values of n but still have 0.50 as the asymptotic value. Computer simulations using skewed variables, ARMA (1,1) models and shifting level models, support the interpretation that the Hurst phenomenon is a pre-asymptotic behavior. It was found in these simulations that: (1) skewness has some (but small) effect; (2) certain shifting level models and a suitable ARMA model having the same correlation structure yield a pre-asymptotic behavior of the expected rescaled range, similar to the Hurst phenomenon; and (3) re-analysis of the Hurst data suggests that this range is within the pre-asymptotic or transient region. Departure from normality and the dependence structure of series act, either individually or in combination, to further accentuate the transient behavior inherent to normal independent random variables. (Humphreys-ISWS)
W80-02332

CHEMICAL AND SUSPENDED-SEDIMENT CHARACTERISTICS OF RIVERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
V. Subramanian.
Journal of Hydrology, Vol 44, No 1/2, p 37-55, November 1979. 12 Fig, 5 Tab, 25 Ref.

Descriptors: *Rivers, *Suspended solids, *Water quality, *Data collections, Chemical properties, Salts, Dissolved solids, Water chemistry, Discharge(Water), Sediment discharge, River basins, Runoff, Cations, Sodium, Potassium, Calcium, Magnesium, Analysis, Chlorine, Bed load, Carbonates, Sulfates, Phosphates, Foreign research, *India.

Based on preliminary investigations, over the period of two years, the chemical quality of the Ganges, Indus, Brahmaputra, Narmada, Tapti, Mahanadi, Godavari, Krishna, Tungabadra, and Cauvery rivers was evaluated. The discharge-weighted composition for Indian rivers was calculated and compared to the world average river water. The total freshwater runoff for the 9 rivers together with that of 40 minor river basins is 168 x 10 to the 10th power cu m/yr, which is about 15% of the global continental water input. The Indian rivers are alkaline and about 25% more concentrated in dissolved salts than the world average. Discharge and downstream variations in the water chemistry for a few selected stations were briefly explained. The range of values for suspended sediments transported by the rivers was shown together with limited seasonal, discharge, and downstream variations. Chemical, sediment and total load have been calculated for Indian rivers, and erosion rates were compared to data for some major world rivers. Indian rivers contribute about 6% of global mass transfer into the world oceans. Of this amount, nearly 5% goes into the Bay of Bengal, and 95% of this material is carried in suspension by the Ganges and Brahmaputra. The chemical data of river waters have been used to predict theoretically the mineral assemblages in carbonate and silicate systems. Preliminary studies, using X-ray diffraction, have been made on the suspended sediments, and the results were compared to theoretical predictions based on water chemistry. It appears that no systematic regional differences are observed in the water chemistry of Indian rivers, and the suspended sediments are typical for monsoonal rivers draining mainly tropical areas. (Humphreys-ISWS)
W80-02400

2B. Precipitation

RECYCLING OF WATER IN THE AMAZON BASIN: AN ISOTOPIC STUDY,
Comissao Nacional de Energia Nuclear, Sao Paulo (Brazil).
For primary bibliographic entry see Field 2A.
W80-02181

MERCURY IN SOUTHERN NEW ENGLAND COASTAL RAINS,
Connecticut Univ., Groton. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-02326

THE QUANTITATIVE MEASUREMENT OF FOG AND RIME DEPOSITION USING FOG-GAUGES,
Tornado and Storm Research Organization, Trowbridge (England).
G. T. Meaden.
Weatherwise, Vol 34, No 10, p 384-390, October 1979. 1 Fig, 5 Ref.

Descriptors: *Fog, *Rime, *Precipitation(Atmospheric), *Gages, Instrumentation, Measurement, Equipment, Foreign research, *England.

In some parts of the world, the deposition of atmospheric moisture from fog forms an important fraction of the total seasonal precipitation. In some, indeed, it represents the primary source of all moisture for the flora and fauna. The proposed universal design has a spherical hollow glass prototype which has been in experimental use for three years. Its diameter is 254 mm, which is convenient because it is exactly double that of a standard British raingage. In wet-fog conditions, the catch drips off continuously into a small-necked collecting vessel beneath, and evaporation losses are small. An alternative practical design for a fog-gage consists of a long cylindrical tube, made from tough weather-resistant plastic, with a diameter slightly smaller than that of a raingage so that it can be fitted into the raingage funnel leaving an annular gap a few millimetres wide. The method has the advantage of considerably increasing the cross-sectional area exposed to drifting fog. The chimney fog-gage self-drains more effectively than does a sphere. It is also easier to wipe downwards any drops that may still be on the outside of the gage at the observation hour. This paper demonstrated that the apparatus required to measure fog-water is simple and inexpensive and the measuring procedure straightforward, so that international standardisation should present few problems. (Humphreys-ISWS)
W80-02333

ASPECTS OF ARIDITY AND DROUGHT IN THE MONSOON CLIMATE OF SRI LANKA,
Mainz Univ. (Germany, F.R.). Dept. of Geography.
M. Domros.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 1 and 2, p 384-394, January and April 1978. 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Droughts, *Monsoons, *Rainfall, Precipitation(Atmospheric), Distribution patterns, Seasonal, Annual, Analytical techniques, Data processing, Climatology, Meteorology, *Sri Lanka.

Typical of the monsoonal rainfall conditions over Sri Lanka are the remarkable inter-annual and seasonal deficits of water, varying considerably in temporal and spatial aspects. Therefore, both the phenomena of aridity and of drought are of great significance from the point of the general monsoon climate of Sri Lanka. This paper investigated the annual and monthly aridity by using the 'aridity index' of De Martonne Lauer showing the increasing exent of aridity from the S.W. quarter to the N.W./N as well as S.E. of Sri Lanka. On the other hand, drought has been studied by the 'drought index' of Gibbs and Maher underlining a considerable interannual rainfall variability, being expressed by the incidence of heavily drought-stricken years as well as by the occurrence of completely drought-free years. It was pointed out that drought can be called a typical, however irregular and spatially limited, phenomenon in the climate of Sri Lanka. This paper investigated the annual and monthly aridity by using the 'aridity index' of Gibbs and Maher underlining a considerable interannual rainfall variability, being expressed by the incidence of heavily drought-stricken years as well as by the occurrence of completely drought-free years. It was pointed out that drought can be called a typical, however irregular and spatially limited, phenomenon in the climate of Sri Lanka. All observations were based on 30-year rainfall data (1931-1960) of monthly and annual figures. (Sims-ISWS)
W80-02346

DYNAMICS OF OROGRAPHIC RAINFALL,
Meteorological Office, Poona (India).
R. P. Sarker, K. C. Sinha Ray, and U. S. De.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 1 and 2, p 335-348, January and April 1978. 15 Fig, 2 Tab, 10 Ref.

Descriptors: *Rainfall, *Orography, *Model studies, Mathematical models, Distribution patterns, Precipitation(Atmospheric), Monsoons, Atmosphere, Cloud physics, Meteorology, *Orographic rainfall, *India.

A two-dimensional dynamical model for orographic rainfall was developed earlier with particular reference to the Western Ghats. The model assumes a saturated atmosphere with neutral static stability. In this paper this model was applied for some more cases in Western Ghats and also for some cases in Khasi and Jaintia hills. With the model the terrain induced vertical velocities were computed, and these were used to compute rainfall. The computed rainfall distribution agreed well with the observed rainfall distribution both for Western Ghats and Khasi and Jaintia hills during the active monsoon situations. The peak in rainfall distribution was seen to be purely an orographic effect. Some modifications were made in the model for its application during the weak monsoon situations. The results for the various cases were discussed vis-a-vis the different synoptic situations. (Sims-ISWS)
W80-02347

2C. Snow, Ice, and Frost

PATTERNED GROUND ON AN ACTIVE MEDIAL MORAINE, JOTUNHEIMEN, NORWAY,
Edinburgh Univ. (Scotland). Dept. of Geology.
C. K. Ballantyne.
Journal of Glaciology, Vol 22, No 87, p 396-401, 1979. 8 Fig, 4 Ref.

Descriptors: *Glaciers, *Glacial soils, *Glacial drift, Rocks, Soils, Ice, Particle size, Sediments, Sediment sorting, Glaciology, Medial moraines, Patterned ground.

Sorted circles and nets formed on the surface of the principal medial moraine on Storbreen, Jotunheimen, Norway, were described. These consist of 'islands' of coarse sand, granules, and small pebbles, surrounded by pebbles and cobbles and underlain by small domes of glacier ice. It was suggested that patterned ground formation on the moraine results from differential ablation in areas of thin (less than 200 mm) debris cover near the glacier snout, where melting is relatively rapid. It is unlikely that supraglacial patterned ground could survive deposition. (Sims-ISWS).
W80-02224

ACCELERATING STRAIN PRECEDING AN AVALANCHE,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
R. A. Sommerfeld.
Journal of Glaciology, Vol 22, No 87, p 402-404, 1979. 3 Fig, 1 Ref.

Descriptors: *Avalanches, *Snow, *Strain, Strain gages, On-site investigations, On-site data collections, Measurement, Mountains, Snowpacks, Mechanical properties, Accelerating strain.

Strain gages set in the snow on an avalanche track recorded accelerating strain for four hours preceeding a naturally released avalanche. On a second occasion when the strain-rate was similar, the strain decelerated and no avalanche occured. (Sims-ISWS)

W80-02309

WATER YIELD INCREASES THROUGH SURFACE DUSTING OF A PERMANENT ICE-FIELD,
White River National Forest, Glenwood Springs, CO.
R. D. Tarum, and J. R. Meiman.
Water Resources Bulletin, Vol 15, No 5, p 1331-1340, October 1979. 5 Fig, 1 Tab, 14 Ref. Bu. Rec. 14-06-D-6598.

Descriptors: *Snowpacks, *Ablation, *Water yield, Snowmelt, Snow management, On-site investigations, Mountains, Snow, Ice, Snow cover, Glaciers, Albedo, Carbon, Dusts, Watersheds(Basins), Runoff, Streamflow, Icefield ablation, Carbon black, Snow albedo modification, Surface dusting.

Water yields from a permanent ice field were increased by 28% through surface dusting with carbon black. On July 4, 1972, approximately 15 acres of a permanent ice field were treated with 150 lbs. per acre of commercial carbon black. The ice field was located on the eastern slope of the Colorado Front Range at an elevation of 11,500 feet. The carbon black was applied by helicopter using a dry applicator slung below a helicopter. The treatment effect was evaluated by control plot observations of melt and streamflow comparison before and after treatment. The ablation plot studies and runoff comparison with an adjacent watershed both indicated a 28% increase in ablation and meltwater runoff, respectively, for the months of July and August. The study indicated that ice fields could be used as cold-storage reservoirs for use in periods of critical water shortages. (Sims-ISWS)
W80-02358

FORMS AT THE BASE OF TILL STRATA AS INDICATORS OF ICE MOVEMENT,
Geologisches Landesamt, Hamburg, (Germany, F.R.).
J. Ehlers, and H-J. Stephan.
Journal of Glaciology, Vol 22, No 87, p 345-355, 1979. 14 Fig, 8 Ref.

Descriptors: *Ice, *Glaciology, *Glacial drift, *On-site investigations, Movement, Till, Stratigraphy, Geomorphology, Shape, Analytical techniques, Erosion, Glacial sediments, Distribution patterns, Ribs, Flutes.

The direction of inland ice movement, in some cases, can be reconstructed by a study of the forms at the base of till strata. These forms are 'ribs' which are formed either as slickensides or as a type of negative 'flute'; 'edges' and 'wedges', which are caused by shearing movements at the base of the ice; or 'undulations', probably created by restricting moements at the base of the ice. These forms appear to be elongated in the direction of ice movement. As these features can easily be measured, they can be used to check, to supplement, or to replace the results of till-fabric measurements. (Humphreys-ISWS)
W80-02360

RECONSTRUCTED PLEISTOCENE ICE-SHEET TEMPERATURES AND GLACIAL EROSION IN NORTHERN SCOTLAND,
Saint Andrews Univ. (Scotland). Dept. of Geography.
J. E. Gordon.
Journal of Glaciology, Vol 22, No 87, p 331-344, 1979. 5 Fig, 2 Tab, 51 Ref.

Descriptors: *Glaciology, *Ice, *Geomorphology, *Analytical techniques, Temperature, Pleistocene epoch, Mathematical models, Model studies, Analysis, Heat flow, Surfaces, Profiles, *Scotland, Ice-sheet, Ice thickness, Accumulation rates.

Pleistocene ice-sheet temperatures were reconstructed for a west-to-east transect across northern Scotland at the ice maximum using a temperature-profile model. Basal freezing was predicted for the central area of the ice sheet and for zones of basal melting on each side to the west and east. Variations in estimates of annual accumulation rate and ice thickness do not greatly alter this general pattern. However, small errors in estimating mean annual temperature at the ice edge and ice-surface temperature lapse-rate may significantly change the pattern of predicted basal temperature regimes, and basal freezing may have extended over the whole of the area considered. Zones of areal scouring occur in both the west and east of the transect, but are absent from the central mountain area. Under some of the temperature conditions modelled, there is a partial spatial coincidence of the areal scouring in the west with predicted areas of basal melting, but almost none in the east. Possibly this is explained because glacial erosion relates to time periods other than the ice maximum. The focus of this study on trying to link glacier theory and geomorphology has raised new questions and problems, and may offer a productive line of approach to understanding the complex form-process relationships in formerly glaciated areas. Computer simulation of the continuous buildup and decay of former ice sheets offers possibilities and may overcome the problems of attempting to correlate 'static' landform patterns in the present landscape with dynamic glaciological conditions and processes. (Humphreys-ISWS)
W80-02361

SOME RESULTS FROM A LINEAR-VISCOUS MODEL OF THE ARCTIC ICE COVER,
Army Terrestrial Sciences Center, Hanover, NH.
W. D. Hibler, III, and W. B. Tucker, III.
Journal of Glaciology, Vol 22, No 87, p 293-304, 1979. 8 Fig, 3 Tab, 12 Ref. NOAA 04-3-0022-33.

Descriptors: *Ice cover, *Sea ice, *Movement, *Forecasting, *Arctic, Mathematical models, Viscosity, Drag, Winds, Currents(Water), Ocean currents, Ice, On-site data collections, Equations, Stress, Atmospheric pressure, Analytical techniques.

In order to assess the effect of non-local stress transferral through the ice cover empirically, a linear viscous model (employing both bulk and shear viscosities) was used to predict drift-rates for one Soviet and two U.S. drifting stations over the time period May 1962 to April 1964. The predictions, based on available atmospheric pressure and ocean-current data, were compared to free-drift results and to observed values. The empirical viscosity values giving the best fit to observations showed a pronounced seasonal variation that correlated well with the growth rate of thin ice. Drift predictions, especially long-term net drift results, showed drift magnitudes and turning angles to be simulated significantly better by a viscous model than by a free-drift model. The effects of steady currents were shown to be small for velocities averaged over days but were significant for averages over years. (Sims-ISWS)
W80-02362

IS VERTICAL SHEAR IN AN ICE SHELF NEGLIBIBLE,
British Antarctic Survey, Cambridge (England).
T. J. O. Sanderson, and C. S. M. Doake.
Journal of Glaciology, Vol 22, No 87, p 285-292, 1979. 3 Fig, 11 Ref.

Descriptors: *Glaciers, *Shear stress, *Movement, *Model studies, Mathematical models, Stress, Shear, Equations, Mechanical properties, Physical properties, Glaciology, *Erebus Glacier, *Amery Ice Shelf, Glacial mechanics.

Vertical shear stress in ice shelves cannot be precisely zero since the upper and lower surfaces are generally not parallel. By performing stress balance on a vertical column in an ice shelf, the magnitude was calculated. This was done for an unconfined glacier tongue and for a confined bay ice shelf; first, using the assumption of constant temperature and density with depth, and second, using realistic data and profiles for Erebus Glacier tongue and for the Amery Ice Shelf. Shear stresses increase almost linearly with depth and are proportional to surface slope. For Erebus Glacier tongue, the shear stress is at most 5% of the magnitude of the direct stress deviators, and its action through the ice shelf should result in differential movement of 1.8 cm/a between the top and bottom of the ice shelf. For the Amery Ice Shelf, the shear stress is at most 0.4% of the magnitude of the direct stress deviators, and this should lead to differential movement of 2.5 cm/a between the top and the bottom of the ice shelf. Shear stresses, therefore, are generally negligible in comparison with direct stress deviators and can be ignored when considering the overall dynamics of ice shelves. Differential movement is unlikely to be detectable. (Sims-ISWS)
W80-02363

SUPRAGLACIAL DEBRIS OF G2 GLACIER IN HIDDEN VALLEY, MUKUT HIMAL, NEPAL,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
M. Nakawo.
Journal of Glaciology, Vol 22, No 87, p 273-283, 1979. 8 Fig, 2 Tab, 26 Ref.

Descriptors: *Glaciers, *Glacial sediments, *Particle size, *Distribution patterns, Glacial drift, Erosion, Sedimentation, Sediments, Sampling, On-site data collections, Ice, Melt water, Mountains, Glaciology, *Nepal, *Himalaya mountains, *Hidden Valley(Nepal), Debris, Glacial debris, Supreaglacial debris.

Field investigations of supraglacial debris were carried out during the monsoon season in 1974 on G2 glacier near Tukche Peak ibn Hidden Valley, Mukut Himal, Nepal. The thickness of the debris layer was observed to increase down-glacier. Laboratory analysis, however, showed a decrease in particle size in the same direction. This decrease was explained in terms of mixing of particles contained in glacier ice with the original debris as melting proceeds. A simple relation between debris mass and glacier flow was introduced to explain the observed results. (Sims-ISWS)
W80-02364

ON THE COMPUTATION OF HEAT TRANSFER COEFFICIENTS FROM ENERGY-BALANCE GRADIENTS ON A GLACIER,
Innabruck Univ. (Austria). Inst fuer Meteorologie und Geophysik.
M. Kuhn.
Journal of Glaciology, Vol 22, No 87, p 263-272, 1979. 4 Tab, 29 Ref.

Descriptors: *Heat transfer, *Glaciers, *Mathematical models, *Surfaces, Ice, Energy budget, Analysis, Analytical techniques, Heat flow, Turbulent flow, Boundary processes, Melting, Temperature, Ablation, Boundaries(Surfaces), Air-ice interfaces, Sensible heat, Energy balance, Heat transfer coefficients.

The turbulent flux of sensible heat in the energy balance of a glacier surface was assumed to be proportional to the temperature difference between the glacier surface and the atmosphere at the same level but outside the thermal influence of the glacier. The factor of proportionality between them was explained in terms of friction velocity, roughness height, and stability function of the logarithmic wind and temperature profile. It was then derived from climatological records and measurements of the energy balance and its altitudinal gradients at Hintereisferner. Examples of the energy-balance and its altitudinal gardients at Hintereisferner. Examples of the energy-balance components and their change with altitude were given for the entire ablation season as well as for short periods. The heat transfer coefficients derived have a mean value of 1.7 plus or minus 0.2 MJ/sq m/d/K. (Humphreys-ISWS)
W80-02365

RHOMBUS AND RHOMBOID PARALLELOGRAM PATTERNS ON GLACIERS: NATURAL INDICATORS OF STRAIN,
Georgia State Univ., Atlanta. Dept. of Geology.
C. J. Waag, and K. Echelmeyer.
Journal of Glaciology, Vol 22, No 87, p 247-261, 1979. 8 Fig, 4 Tab, 11 Ref.

Descriptors: *Glaciers, *On-site investigations, *Strain, *Alaska, Ice, On-site tests, Measurement, Distribution patterns, Strain measurement, Analytical techniques, Shape, Cracks, Maps, Crystallography, Crystals, Stress analysis, Firn, Parallelogram patterns, Strain rates.

Subtle rhombus and rhomboid parallelogram patterns occur on Vaughan Lewis Glacier and the Gilkey Glacier System, Juneau Icefield, Alaska. The patterns are within the firn at the firn-ice interface, are formed by differential recrystallization within narrow preferred zones, and are apparently manifestations of stresses transferred upward from the glacier ice. On the glaciers of the Gilkey System the patterns occur where intense lateral shortening is indicated by abrupt convergence of medial moraines and an abundance of extension crevasses. The short axes of the rhombi and the obtuse angle bisectors of the rhomboids are subparallel to the strike of extension crevasses, and therefore to the axis of shortening. The long axes of the rhombi and the acute angle bisectors of the rhomboids are parallel to the foliation and ice-flow direction. The angles of the parallelograms are variable locally, but average 105 deg and 75 deg; the variation seems to reflect intensity and duration of stress. Similar parallelograms occur within the troughs of wave bulges below the Vaughan Lewis Icefall. In the wave bulges, the foliation arcs parallel the wave. The long axes of the rhombi and acute angle bisectors of the rhomboids parallel the foliation around the foliation arc. The short axes of the rhombi and the obtuse angle bisectors of the rhomboids parallel the strikes of radial crevasses, are perpendicular to the direction of extension, and form a fan divergent downstream. The precise mechanisms and conditions of formation of the parallelograms are not yet understood. Preliminary strain-rate measurements suggest, however, that correlations exist between the orientations of the principal strain-rates and the axes of the patterns, and between the magnitude of the strain-rates and the axial lengths of the patterns. (Humphreys-ISWS)
W80-02366

2D. Evaporation and Transpiration

EXPERIMENTAL INVESTIGATION OF EVAPOTRANSPIRATION,
Minnesota Univ., St. Paul. Dept of Soil Science.
J. E. Ljungkull, D. G. Baker, and J. B. Swan.
In: American Meteorological Society, Fourteenth Conference on Agriculture and Forest Meteorology and Fourth Conference on Biometeorology, extended abstracts, p 169. American Meteorological Society, Boston, 1979. OWRT B-147-MINN (1) 14-34-0001-9119.

Descriptors: *Evapotranspiration, *Measurement, *Lysimeters, *Analytical techniques, Water utilization, Land use, Microclimatology, *St. Paul, MN.

Evapotranspiration is one element in the hydrologic cycle which is not measured on a routine basis anywhere in the North Central Region except St. Paul, Minnesota. The recently installed weighing lysimeter at the microclimatological station on the St. Paul Campus of the University of Minnesota allows precise, short term measurements of evapotranspiration to be made. Simultaneous measurement of other climatic variables provide the data for the formulas frequently used to estimate evapotranspiration. During the summer of 1978 data was taken from June 9 through October 10. Preliminary statistical analysis of the data indicated that during this period pan evaporation was a good predictor of evapotranspiration, accounting for about 88 percent of the variation in the measured evapotranspiration. (Blake-Minn)
W80-02051

RECYCLING OF WATER IN THE AMAZON BASIN: AN ISOTOPIC STUDY,
Comissao Nacional de Energia Nuclear, Sao Paulo (Brazil).
For primary bibliographic entry see Field 2A.
W80-02181

DAYTIME ENERGY EXCHANGE AND EVAPORATION FROM A WOODED SWAMP,
Toronto Univ. (Ontario). Dept. of Geography.
D. S. Munro.
Water Resources Research, Vol 1 5, No 5, p 1259-1265, October 1979. 3 Fig, 2 Tab, 22 Ref.

Descriptors: *Evaporation, *Energy loss, *Canada, Energy transfer, Equilibrium, Swamps, Moisture, Soils, Vegetation effects, Micrometeorology, *Energy exchange, *Ontario(Canada), *Energy balance, Wooded swamps, Bowen ratio.

Hourly values of daytime energy balance components were obtained for 5 days in late summer at a wooded swamp in southern Ontario. Bowen ratio estimates of the energy used in evaporation were compared with values obtained from the equilibrium form of the combination model. Agreement between the two methods was found to be poor for hourly values, but better in the case of daytime totals, where the proportion of Bowen ratio to equilibrium estimates varied from 0.7 to 1.04. The results did not support the use of a potential evaporation formula despite an apparently nonlimiting supply of moisture in the soil. There was some support in the findings for the existence of an equilibrium evaporation regime. An equilibrium evaporation regime implies that vegetative control can be ignored in long-term evaporation work. If true, such a regime could simplify the task of estimating water loss from a swamp. (Roberts-ISWS) t the amount of organic polluants being dumped into rivers in order to safeguard the life, quality and productivity of the fish existing in the river. (Deal-EIS)
W80-02182

CHARACTERIZATION OF ARID CLIMATES ACCORDING TO COMBINED WATER BALANCE PARAMETERS,
California Univ., Berkeley. Dept. of Geography.
T. M. Oberlander.
Journal of Arid Environments, Vol 2, p 219-241, 1979. 6 Fig, 1 Tab, 27 Ref.

Descriptors: *Climatic zones, *Weather data, *Arid climates, *Water balance, Moisture regime, Soil moisture, Potential evapotranspiration, Thornthwaite's Aridity Index.

An attempt is made here to devise an extended characterization of the climates rather than the actual moisture regime as conditioned by local edaphic factors at individual sites. A supplementary water balance index is proposed with the objectives of determining the nature of climatic conditions in the dry realm, discovering true climatic analogies in widely separated locations, and devising a means of categorizing and comparing climates numerically without cumbersome manipulative procedures. Positive values of this index make distinctions between climates permitting soil moisture storage, while negative values differentiate between climates producing year-round moisture deficit. Graphic plots are presented of potential evapotranspiration and Thornthwaite's Aridity Index as well as of this water balance index to facilitate the recognition of true arid region climatic analogies and permit precise characterization of the climates of different arid regions. It is hoped that these results will be useful to investigators of diverse aspects of arid environments. (Tickes-Arizona)
W80-02208

2E. Streamflow and Runoff

FLOOD PLAIN INFORMATION: KUSKOKWIM RIVER, MCGRATH, ALASKA.
Army Engineer District, Anchorage, AK.
Prepared for City of McGrath, Alaska, September 1977. 18 p, 9 Fig, 9 Plates, 1 Tab.

Descriptors: *Alaska, *Flooding, *Flood frequency, *Flow characteristics, *Ice jams, *Kuskokwim River(AK), *McGrath(AK), Floods, Indirect flood measurement, Maximum probable flood, Flood forecasting, Historic floods, Flood data, Flood stages, Peak discharge, Flood peak, Flow duration, Rivers, Flood protection, Warning systems, Crooked Creek(AK), 100-year flood, 500-year flood.

The study area encompasses the Kuskokwim River flood plain surrounding the city of McGrath, Alaska. The lands in the study area are primarily settled on the left bank of the Kuskokwim River in and around the City of McGrath with both residential and commercial structures. Several residential buildings also exist on the right bank of the river. There are no bridges or other man-made obstructions on the Kuskokwim River within the study area. There are no existing flood control structures on the Kuskokwim River. Flood data were obtained from two U.S. Geological Survey stream gages and interviews with long-term residents. Flooding in the study area generally occurs in mid-May, caused by ice jams. Fall flooding has occurred due to intense rains during August and September. The greatest recorded flood occurred on May 18, 1972 and was caused by an ice jam downstream of McGrath. A water surface elevation of 337.9 feet above mean sea level was reported. The 100-year flood would have a peak flow of 110,000 cubic feet per second (cfs), with an elevation of 337.7 feet mean sea level (msl), while the 500-year flood would have a peak discharge of 143,000 cfs and an elevation of 339.6 feet msl. Potential ice jam floods pose serious flood hazards, and the estimate for such floods is an elevation of 339.0 feet msl. This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management. (Coan-NC)
W80-02014

FLOOD PLAIN INFORMATION: DRY CREEK, BOULDER COUNTY-WELD COUNTY, COLORADO.
Army Engineer District, Omaha, NE.
Prepared for Boulder County and Weld County, Colorado, and Colorado Water Conservation Board, June 1978. 28 p, 16 Fig, 33 Plates, 3 Tab.

Descriptors: *Colorado, *Flooding, *Flood profiles, *Peak discharge, *Flood plains, *Weld County(CO), *Boulder County(CO), *Dry Creek(CO), 100-year flood, 500-year flood, Floods, Indirect flood measurement, Storms, Cloudbursts, Historic floods, Flood data, Flood frequency, Flood stages, Flow duration, Flow characteristics, Rivers, Flood protection, Non-structural alternatives, Flood plain zoning, Warning systems, Reservoirs.

The study area is the flood plain of Dry Creek extending from Boulder Reservoir in Eastern Boulder County to the confluence of Dry Creek and St. Vrain Creek in southwestern Weld County. Development within the flood plain is relatively sparse consisting mainly of agricultural lands. Flood data were obtained from flood records, topographic maps, and aerial photographs. There are no flood control structures as such, but many irrigation reservoirs provide incidental flood protection. Floods in the study area generally occur from May through September and result from very intense rainfall of cloudburst magnitude. No stream gaging stations were located on Dry Creek which have recorded past flood peak discharges. Because of the rural nature of the study area, little information is available on historic flooding. The peak discharge for the 100-year flood is estimated to be 2,700 cubic feet per second (cfs), with an elevation of 5003.1 feet mean sea level (msl). For the 500-year flood, the peak discharge would be 4,495 cfs, with an elevation of 5003.8 feet msl. This report provides a suitable basis for the adoption of land use controls to guide flood plain development with consideration for environmental attributes. (Coan-NC)
W80-02015

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 2, BRUSH BAYOU AND TRIBUTARIES.
Army Engineer District, New Orleans, LA.
Prepared for the City of Shreveport, LA, February 1974. 34 p, 23 Fig, 34 Plates, 9 Tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Peak discharge, *Brush Bayou(LA), *Shreveport(LA), Floods, Indirect flood measurement, Flood forecasting, Historic floods, Flood data, Flood stages, Flood peak, Flow duration, Flor characteristics, Flood damage, Stream erosion, Flood protection, Warning systems, Control structures, Channel improvement, Standard project flood, Intermediate regional flood.

The study area includes the city of Shreveport and surrounding area located in the flood plains of Brush Bayou. Development in the flood plains is primarily residential but includes commercial and industrial mixes. Flood data were obtained from U.S. Geological Survey gaging and precipitation stations, newspaper files, historical documents and interviews with local residents. Major floods occur in the study area during all seasons, but appear most frequently during summer and fall. These floods result from heavy rainfall and occasionally from hurricane activity. Channel alterations are the only flood damage reduction measures completed in the area. The worst recorded flood occurred July 25, 1933 but no recorded discharge exists. In March 1969 a major flood discharged 2,020 cubic feet per second (cfs), rising to 167 feet mean sea level datum (msd), measured at Mt. Zion Bridge on Brush Bayou. Other large floods occurred in 1968, 1969, 1970, 1971, and 1972. The Intermediate Regional Flood occurring in the lower limit of the study area would have a peak discharge of 12,760 cfs, reaching a height of 6.2 feet and remaining 7 hours above bankfull stage. The Standard Project Flood at the lower limit of the study area would discharge 23,370 cfs and reach a height of rise of 11.3 feet. This report provides a suitable basis for the adoption of land use controls to guide flood plain development. (Coan-NC)
W80-02016

FLOOD PLAIN INFORMATION: PEARL RIVER, BOGUE LUSA AND COBURN CREEKS VICINITY OF BOGALUSA, LA.
Army Engineer District, Mobile, AL.
Prepared for The City of Bogalusa, LA, June 1973. 24 p, 5 Fig, 13 Plates, 11 Tab.

Descriptors: *Louisiana, *Flooding, *Flood data, *Peak discharge, *Bogue Lusa Creek(LA), *Coburn Creek(LA), *Pearl Creek(LA), Floods, Indirect flood measurement, Flood profiles, Historic floods, Flood frequency, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Standard Project Flood, Flood protection, Warning systems, Bogalusa(LA), Intermediate Regional Flood.

The study area includes land in the vicinity of Bogalusa, Louisiana and located in the flood plains of Bogue Lusa Creek, Coburn Creek, and Pearl River. The flood plains of Bogue Lusa Creek and Coburn Creek are primarily residential while that of Pearl River includes considerable commercial development. Flood data were obtained from U.S. Geological Survey stream gaging stations, U.S. Soil Conservation Service maps, newspaper files and interviews. The main flood season is in winter and spring but flooding may occur at any time of the year. There are no existing or proposed flood control measures on Bogue Lusa or Coburn Creeks or Pearl River. The worst recorded floods on Bogue Lusa Creek, Coburn Creek, and Pearl River reached peak discharges of 24,800 cubic feet per second (cfs) on November 14, 1961, 5,600 cfs on November 14, 1961, and 88,200 cfs on February 23, 1961, respectively. The Intermediate Regional Flood (IRF) on Bogue Lusa Creek near the State Highway 21 Bridge would have a peak discharge of 39,800 cfs, while the Standard Project Flood (SPF) would reach 60,000 cfs. On Coburn Creek at the State Highway 21 Bridge, the peak discharge for the IRF would be 9,200 cfs and for the SPF, 13,300 cfs. The IRF on Pearl River would have a peak discharge of 145,000 cfs and the SPF would discharge 285,000 cfs. This report is intended to provide a suitable basis for adopting land use controls to guide flood plain development and aid in identifying other flood damage reduction techniques. (Coan-NC)
W80-02017

FLOOD PLAIN INFORMATION: UPPER WHITE ROCK CREEK, PLANO, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Plano, Texas, May 1974. 34 p, 9 Fig, 12 Plates, 6 Tab.

Descriptors: *Texas, *Flooding, *Flood data, *Flood frequency, *Plano(TX), *Upper White Rock Creek(TX), Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Historic floods, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood protection, Warning systems, Standard Project Flood, Dallas(TX), Intermediate Regional Flood.

The study area covered in this report is the Upper White Rock Creek flood plain within and around the city of Plano, Texas. Little development exists in the flood plain but the city of Plano is expected to grow rapidly in the upcoming years. Data were collected from U.S. Geological Survey reports, a stream gage at Keller Springs Road, Texas Highway Department files, newspaper files, interviews with local residents and field investigations. There are no flood damage prevention measures in the study area at this time. The major floods occurring in the study area are produced by heavy rainfall from frontal type storms, usually in the spring and summer months. Localized thunderstorms of intense rainfall may also cause flooding at any time of the year. The highest known flood occurred on September 21, 1964, with a peak discharge of 37,900 cubic feet per second (cfs), reaching a gage height elevation of 574.5 feet. At Keller Springs Road, the Intermediate Regional Flood would discharge 30,800 cfs while the Standard Project Flood would discharge 53,200 cfs. The main purpose of this report is to provide guidance for intelligent land use in the upper White Rock Creek area. The report details regulatory measures to minimize damage from flooding, including flood plain zoning ordinances, building codes, structural measures, flood insurance and others. (Coan-NC)
W80-02019

FLOOD PLAIN INFORMATION: MARINE CREEK, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Fort Worth, TX. September 1974. 34 p, 8 Fig, 10 Plates, 5 Tab.

Descriptors: *Texas, *Flooding, *Flood profiles, *Flood data, *Peak discharge, *Fort Worth(TX), *Marine Creek(TX), Floods, Indirect flood measurement, Flood forecasting, Historic floods, Flood frequency, Flood stages, Flood peak, Standard project flood, Flood protection, Warning systems, Dams, Channel improvement, Intermediate Regional Flood.

The study area is the Marine Creek flood plain in the vicinity of Fort Worth, Texas. The area encompasses about 9.4 miles of channel. The upper portion of the floodplain is mainly rural in nature except for occasional scattered pockets of residential, commercial, and industrial development along the highways and roads serving the area. The area of the flood plain below Marine Creek Lake is highly urbanized. Flood data were gathered from historical records and newspaper files; there are no operating stream gaging stations on Marine Creek. At present, there are two flood control structures in the watershed, Marine Creek Dam and Cement Creek Dam. Most of the flooding occurs during the spring and fall resulting from prolonged or successive storms that produce heavy rainfall. The worst recorded floods were a series of three different floods occurring during the week of 19 April, 1942. There was no information available on the peak discharges. The maximum known discharge on streams in the region of Marine Creek occurred in September 1964, discharging 38,100 cubic feet per second (cfs) on White Rock Creek. The Intermediate Regional Flood (IRF) for Marine Creek would have a peak discharge of 12,800 cfs above Main Street, reaching a height of rise above bankfull stage of 3.2 feet, and lasting for 1.1 hours. The Standard Project Flood (SPF) would have a peak discharge of 19,800 cfs, reach a height of rise of 6.6 feet above bankfull stage, and last for 2.9 hours. This report is intended to provide appropriate governmental bodies with data to aid in planning the best use of flood prone lands or contribute to the solution of local flood problems. (Coan-NC)
W80-02020

FLOOD PLAIN INFORMATION: PARTS I AND II: TAOS COUNTY - NEW MEXICO.
Army Engineer District, Albuquerque, NM.
Prepared for The City and County of Taos, NM, June 1977. 27 p, 3 Fig, 54 Plates, 5 Tab.

Descriptors: *New Mexico, *Flooding, *Flood profiles, *Flood data, *Peak discharge, *Taos(NM), *Taos County(NM), Floods, Indirect flood measurement, Maximum probable flood, Historic floods, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood protection, Warning systems, Control structures, Rio Fernando de Taos(NM), 100-year flood, 500-year flood.

The study area includes the Rio Fernando de Taos River flood plain and the flood plains of its tributaries near Taos, New Mexico. Developments in the flood plains consist primarily of agricultural land; there is no residential and commercial development in the flood plain. Flood data were obtained from stream gaging stations, topographic maps, historical records, newspaper files, and interviews with local residents. The Las Cruces Arroyo Floodwater retarding structure is the only structure in the study area controlling floodflow. No other flood control projects have been authorized. Major flood-producing storms are most likely to occur during the transitional periods between spring and summer, and summer and fall. Precipitation usually occurs from thunderstorm activity caused by intermittent inflow of tropical Gulf air. Not much information is available on historic floods and no estimates of discharge or worst floods are made. The peak discharge for the 100-year flood is estimated to be 1,000 cubic feet per second (cfs), reaching a height of rise of 1.6 feet at the Grant Boundary Line. The 500-year flood would have a peak discharge of 1,600 cfs, with a height of rise of 2.1 feet, occurring at the mouth of the Rio Fernando de Taos River. This report will aid in the development of flood damage reduction techniques, land use planning of flood plains, and an Overall Flood Plain Management (FPM) program. (Coan-NC)
W80-02021

FLOOD HAZARD ANALYSES: NORTH FORK - NEW RIVER, ASHE COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
Prepared for Ashe County, NC, May 1979. 11 p, 1 Fig, 1 Plate, 2 Tab, 8 Append.

Descriptors: *North Carolina, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Flood profiles, *Storms, *Hurricanes, *Flood stages, *Peak discharge, *Flood peak, *Ashe County(NC), *North Fork-New River(NC), *New River(NC), Historic floods, Flood data, Rivers, Floodways, Flood plains, Flood plain management, Flood protection, Non-structural alternatives, Flood plain insurance, 100-year flood, 500-year flood.

This report studies the flood hazard in Ashe County, NC, and focuses on the North Fork-New River. Separate reports were prepared for South Fork-New River and Beaver and Naked Creeks. The North Fork-New River joins with the South Fork-New River at the Ashe-Alleghany County line to become the New River which becomes the Kanawha River in West Virginia and flows into the Ohio River. The study area is characterized by numerous mountains with rolling country between the mountains. The North Fork-New River has a drainage area of 289 square miles at its confluence with the South Fork-New River. In the 30.6 mile length of the North Fork 1,948 acres and 2,385 acres are inundated by the 100- and 500-year floods, respectively. Development in the floodplain is primarily rural homes. Flooding is caused by locally intense thunderstorms and hurricanes and occurs throughout the year. Historical flood records show the August 1940 flood was the larg-

est since 1908 when stream gage records were started. This flood was greater than the projected 100-year flood. The most recent flood occurred in 1978 and approached the 100-year flood. For the 100-year flood, discharges would range from 2,160 cubic feet per second (cfs) to 36,242 cfs at different cross sections, and the maximum elevation would reach 3,330 feet mean sea level (msl). For the 500-year flood, discharges would range from 4,018 cfs to 67,410 cfs, with a maximum elevation of 3,331 msl. Ashe County has no floodplain regulations, nor has it established structural flood control measures, but it does participate in the national flood insurance program. A flood plain management program is recommended for the County. (Iervolino-NC)
W80-02030

FLOOD HAZARD ANALYSES: ARARAT RIVER, SURRY COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
Prepared for Surry County, NC, April 1979. 13 p, 1 Fig, 1 Plate, 1 Tab, 8 Append.

Descriptors: *North Carolina, *Floods, *Flooding, *Flood flow, *Indirect flood measurement, *Flood profiles, *Storms, *Hurricanes, *Surry County(NC), *Mt Airy(NC), *Ararat River(NC), Historic floods, Flood data, Flood stages, Flood peak, Rivers, Floodways, Flood plains, Flood plain management, Flood protection, Non-structural alternatives, Flood plain insurance, Building codes, Zoning, 100-year flood, 500-year flood, Stewarts Creek(NC), Lovills Creek(NC).

This report is the second part of the flood hazard analysis for Surry County, NC, in the vicinity of Mt. Airy. The study area is the flood plain of a 9.5 stretch of the Ararat River which is a tributary to the Yadkin River. The drainage area of the Ararat River is 36 square miles plus 151 square mile drainage area of two of its tributaries--Stewarts and Lovills Creeks. Development in the flood plain is limited residential and commercial where the state road system crosses the flood plain. The Ararat flood plain is located in the Piedmont Plateau of the state and is characterized by hills, narrow ridges and low knobs. Flooding is caused by locally intense thunderstorms, general large area storms and hurricanes throughout the year. The largest flood occurred on June 14, 1947 and as recorded by stream gages was greater than the 100-year flood. In 1975 there were six flood events recorded at the Ararat stream gage; the largest occurred on Sept. 4 and equalled the two-year event. In a 100-year flood 562 acres would be flooded to a maximum elevation of 1,094.7 feet mean sea level (msl). The maximum elevation for the 500-year flood would be 1,096 msl, with 665 acres flooded. Mt. Airy in 1974 became elegible for flood insurance but Surry County is still not in the program. Flood plain management techniques are described, both regulatory measures such as flood plain regulations, land use restrictions and flood insurance, and corrective measures such as land treatments, stream improvements, floodwalls or levees and warning systems. (Iervolino-NC)
W80-02031

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX IX-FLOOD CONTROL.
California Region Framework Study Committee.
For primary bibliographic entry see Field 4A.
W80-02034

A NEW COLLOCATION METHOD FOR THE SOLUTION OF THE CONVECTION-DOMINATED TRANSPORT EQUATION,
Princeton Univ., NJ. Dept. of Civil Engineering.
G. E. Pinder, and A. Shapiro.
Water Resources Research, Vol 15, No 5, p 1177-1182, October 1979. 7 Fig, 4 Ref.

Descriptors: *Model studies, *Mathematical models, *Analytical techniques, Flow, Convection, Mass transfer, Diffusion, Equations, Functions, Mathematics, Methodology, Transport equations, Collocation methods.

A modified Hermitian basis function was developed as a means of enhancing numerical solutions to the convection-dominated transport equation using orthogonal collocation. An asymmetric approximation to the first-order spatial derivative was provided so that oscillations in the numerical solution were eliminated while introducing a minimum amount of numerical dispersion. The degree of assymetry in the basis function required to achieve a smooth solution was shown to be dependent upon the magnitude of the convective and disperive terms. (Sims-ISWS)
W80-02177

SYNTHETIC HYDROLOGIC INFORMATION--A CASE STUDY,
Illinois State Water Survey, Urbana.
K. P. Singh.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY10, Proceedings Paper 14922, p 1257-1275, October 1979. 4 Fig, 7 Tab, 11 Ref, 2 Append.

Descriptors: *Flood control, *Hydrologic data, *Illinois, Model studies, Lakes, Maximum probable flood, Navigation, Reservoir operation, Synthetic hydrology, Water resources, Water supply, Hydrology, *Lake Carlyle(IL), *Lake Shelbyville(IL).

Methodologies were developed for generating synthetic hydrologic information in respect to weekly flows, precipitation on and evaporation from the lake surfaces, and navigation flow requirements to investigate: (1) the range of response with the optimal joint operation (derived with the historical data) of the Shelbyville and Carlyle Lakes in Illinois, and (2) any desirable improvements in operation. A two-distribution model was shown to be better than the Pearson or normal distribution model for generating monthly streamflows. A method for filtering outliers was predicated on the basis of hydrometeorology and rainfall-runoff phenomenon. A disaggregation procedure was formulated for converting monthly flows to weekly flows. Markov models were used successfully in generating monthly precipitation on and evaporation from the lake surfaces. The weekly navigation-flow requirements were simulated by a third-order Markov chain. (Lee-ISWS)
W80-02185

MISSISSIPPI RIVER SHOALING: A DIAGNOSTIC STUDY,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
T. Nakto, R. M. Baker, and J. F. Kennedy.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings paper 14978, p 1375-1391, November 1979. 10 Fig, 1 Tab, 14 Ref, 1 Append. DACW-25-76-C-0037.

Descriptors: *Bed load, *Shoals, *Mississippi River, Dredging, On-site data collections, Navigation, Sediment transport, Suspended load, Reach(Streams), *Shoaling, Sediment movement, Sediment input, Empirical relationships, Mean flow velocity, Water discharge, Diagnostic study.

A field study was conducted to collect definitive data on the flow and sediment movement characteristics in the recurrent shoaling reaches of the Mississippi River in the vicinities of Fox Island and Buzzard Island in Pool 20 between Keikup, Iowa, and Canton, Missouri. Detailed field data were used to identify the source of the excess sediment input into the Mississippi River and to elucidate the principal mechanisms of shoaling processes in the study areas by establishing empirical relationships of the bed load discharge and the suspended load discharge with the mean flow velocity and the water discharge. (Roberts-ISWS)
W80-02186

GENERALIZED DISTRIBUTION OF TURBULENT DIFFUSIVITY,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
J. C. Willis.
Journal of Hydraulic Research, Vol 17, No 3, p 231-250, 1979. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Diffusivity, *Mathematical models, *Open channel flow, *Turbulent flow, Mathematical studies, Model studies, Velocity, Distribution, Theoretical analysis, Analytical techniques, Equations, Suspended solids, Flow, Eddy viscosity, Diffusivity distribution, Sediment concentration, Error function.

Derivations of distributions of diffusivity, flow velocity, and sediment concentration over the flow depth were made for a generalized normalization of the relative distance from the floow boundary. Boundary condition restraints suggest a normalization function with a finite lower limit and an infinite upper limit. In analytical considerations, the distribution functions were discussed relative to an unspecified mean turbulent diffusivity. An analysis of the distributions was made in terms of their limits at the channel boundary and the free surface (or top of the boundary layer). The analytical developments were then applied to three models that have been used previously. Besides the parabolic and error function distributions of diffusivity, an expression for the diffusivity distribution was derived from the power function model for the velocity distribution. A numerical solution for the concentration distribution was made based on this diffusivity distribution. Two new normalization unction were investigated in some detail. These were the Rayleigh function and the gamma function. Of the models investigated herein, the gamma function offers the greatest promise as a generally applicable model for turbulent diffusivity. If appropriate parameters are selected, it satisfies both boundary conditions on the velocity and is asymtotic to the error function, which also satisfies the velocity-slope boundary condition at the water surface. Any normalized probability function was shown to be expressible as a potential model for the turbulent diffusivity. A consideration of all available functions is beyond the scope of this paper; however, the analysis procedure used in terms of the functional form and boundary conditions should be generally applicable and should serve as a basis for comparison of potentia! models. Possibly these concepts will stimulate the development and experimental verification of better diffusivity models for describing fluid flow phenomena. (Humphreys-ISWS)
W80-02192

POTAMOLOGY IN 1932: LOWER MISSISSIPPI RIVER,
Pyburn and Odom, Inc., Baton Rouge, LA.
L. M. Odom.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14993, p 405-420, November 1979. 3 Fig, 5 Ref, 1 Append.

Descriptors: *Mississippi River, *Flood control, *Potamology, *Reviews, History, Erosion, Stream erosion, Streamflow, Floods, Sediments, Sediment transport, Sedimentation, Cutoffs, Channel improvement, Navigation, Rivers, Hydraulics.

A review was presented of the knowledge of the science of rivers as it stood in 1932 as described in the Mississippi River Commission Report published that year entitled 'Improvement of the Lower Mississippi River for Flood Control and Navigation'. The conclusions and recommendations given in the report are still in general use by today's designers of river control and maintenance works. While the prime reason for preparing this paper was to make available to younger engineers a summary of the knowledge of potamology contained in this long-out-of-print report, it is also hoped that it will initiate and stimulate analysis. Renewed emphasis is needed for obtaining data from the prototype streams, particularly in view of the late developments in electronic and computerized devices for use in surveying, sampling, and storage and analysis of data. (Sims-ISWS)
W80-02337

FLOOD FREQUENCY ESTIMATES ON ALLUVIAL FANS,

Dames and Moore, Washington, DC.
D. R. Dawdy.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 15001, p 1407-1413, November 1979. 1 Tab, 3 Ref, 2 Append.

Descriptors: *Flood frequency, *Mathematical models, *Alluvial fans, *Geomorphology, Model studies, Analytical techniques, Theoretical analysis, Floods, Alluvial channels, Open channel flow, Flood flow, Flood routing, Hydraulic geometry.

A uniform method was presented for the determination of flood flow frequencies on alluvial fans. The method was based on geomorphologic principles, and has general applicability. There are three basic assumptions underlying the proposed method. The first assumes that a oog Pearson III distribution applies to the distriburion of flood flows at the apex. The second basic assumption is that each event forms a single channel and flow remains in that channel throughout the event. The third basic assumption is that flood channels are distributed uniformly across any contour. The concept is basically reasonable, but it ignores the fact that equally valid assumptions concerning placing of channels and placing of centers of channels would result in different probabilities, particularly within one stream width of the edge of an alluvial fan. (Humphreys-ISWS)
W80-02342

DOWNSTREAM EFFECTS OF STORMWATER MANAGEMENT BASINS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 14977, p 1343-1356, November 1979. 5 Fig, 6 Tab, 8 Ref, 1 Append.

Descriptors: *Runoff, *Urban runoff, *Detention reservoirs, *Sediments, Drainage, Storms, Storm runoff, Flood control, Effects, Cities, Urbanization, Bedload, Erosion, Channels, Storm water, Hydrology, Water management(Applied), Stormwater basins, Downstream effects.

Urbanization decreases the natural storage of a watershed, which changes the timing characteristics of the runoff. Stormwater management (SWM) basins are an attempt to put the storage lost through development back into the runoff process. While SWM basins provide the proper volume of storage, they fail to return the timing characteristics to those that existed prior to development. The changes in storage and timing characteristics may have adverse effects on flow rates and bedload transport in downstream channel reaches. A study of a 2.12-sq mile watershed in Montgomery County, Maryland, showed that a SWM basin increased both peak flows and bedload transport rates in the channel downstream from the facility. This results from both the change in timing characteristics and the increased duration of bankfull flow. These results indicated that SWM policies must require evaluation os SWM plans on a regional basis and not just using on-site control criteria. Also, methods that can evaluate storage and timing changes must be used in the design of SWM facilities. (Sims-ISWS)
W80-02345

REGIONAL RUNOFF SIMULATION FOR SOUTHEAST MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. A. Derecki, and A. J. Potok.
Water Resources Bulletin, Vol 15, No 5, p 1418-1429, October 1979. 6 Fig, 2 Tab, 3 Ref.

Descriptors: *Runoff, *Michigan, Basins, Watersheds(Basins), Soil moisture, Evapotranspiration, Rivers, Drainage, Model studies, Mathematical models, Precipitation(Atmospheric), Hydrology, Forecasting, *Lake Michigan Basin.

The feasibility of simulating monthly runoff for the southeastern portion of the Lake Michigan drainage basin, which comprises four major river basins, was evaluated with the Streamflow Synthesis and Reservoir Regulation watershed model. The evaluation covered a 13-year period (1961-73), which encompassed a complete runoff cycle. Results indicated that it is feasible to simulate monthly runoff volumes on a regional scale with a single equivalent watershed by using daily precipitation and temperature data. Simulation of regional flows appears particularly attractive for the Great Lakes basin, since the basin consists of many relatively small watersheds. This method also appears promising for development of monthly runoff forecasts by employing average monthly meteorological data distributed on a daily basis. Tests of six-month runoff forecasts showed relatively small deterioration with time and offered considerable improvement over climatology. (Sims-ISWS)
W80-02355

2F. Groundwater

A STATISTICAL APPROACH TO THE INVERSE PROBLEM OF AQUIFER HYDROLOGY, 1. THEORY,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. P. Neuman, and S. Yakowitz.
Water Resources Research, Vol 15, No 4, p 845-860, August 1979. 8 Fig, 2Tab, 48 Ref. OWRT B-051-ARIZ (2), 14-34-001-7135.

Descriptors: *Aquifer characteristics, *Statistical methods, *Regression analysis, *Transmissivity, *Heterogeneity, Aquifers, Numerical analysis, Water levels, Groundwater, Groundwater basins, Pump testing. Covariance, Pump test data.

A new, statistically based approach to the problem of estimating spatially varying aquifer transmissivities on the basis of steady state water level data was presented. The method involves solving a family of generalized nonlinear regression problems and then selecting one particular solution from this family by means of a comparative analysis of residuals. A linearized error analysis of the solution was included. This analysis allowed one to estimate the covariance of the transmissivity estimates as well as the square error of the estimates of hydraulic head. In addition to the explicitly statistical orientation of the method, it has an additional feature of permitting the user to incorporate a priori information about the transmissivities. This information may be based on actual field data such as pumping tests, or on statistical data accumulated from similar aquifers elsewhere in the world. A highly efficient explicit numerical scheme for solving the inverse problem in an approximate manner when errors in water level data are sufficiently small was also described. When these errors are large, the explicit scheme may still be useful for obtaining a rapid initial idea about the approximate location of the optimum solution. The theory was presented and was illustrated by a theoretical example. The purpose of this example was to demonstrate the effectiveness of the method in dealing with noisy data obtained from a known model. (Adams-ISWS)
W80-02050

BOUNDARY INTEGRAL EQUATION SOLUTION TO AXISYMMETRIC POTENTIAL FLOWS, 1. BASIC FORMULATION,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. P. Lennon, P. L-F. Liu, and J. A. Liggett.
Water Resources, Vol 15, No 5, p 1102-1106, October 1979. 5 Fig, 2 Tab, 10 Ref. NSF ENG 77-01479.

Descriptors: *Potential flow, *Boundaries(Surfaces), *Mathematical models, *Numerical analysis, *Free suraces, Equations, Groundwater movement, Unsteady flow, Steady flow, Mathematical studies, Boundary integral equation method, Axisymmetric flow.

In this paper the two-dimensional boundary integral equation method (BIEM) was extended to problems of axisymmetric flow governed by Laplace's equation. An 'axisymmetric' Green's function was defined, which led to a calculation procedure that parallels the two-dimensional theory. The result was a numerical method which is efficient and accurate for a variety of axisymmetric potential flow problems. (See also W80-02162) (Visocky-ISWS)
W80-02161

BOUNDARY INTEGRAL EQUATION SOLUTION TO AXISYMMETRIC POTENTIAL FLOWS, 2. RECHARGE AND WELL PROBLEMS IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
G. P. Lennon, P. L-F. Liu, and J. A. Liggett.
Water Resources Research, Vol 15, p 1107-1115, October 1979. 15 Fig, 1 Tab, 14 Ref. NSF ENG 77-01479.

Descriptors: *Potential flow, *Groundwater recharge, *Porous media, *Mathematical models, *Numerical analysis, Aquifers, Wells, Drawdown, Equations, Steady flow, Unsteady flow, Finite element analysis, Dupuit-Forchheimer theory, Boundary integral equation method, Axisymmetric flow.

The boundary integral equation method (BIEM) was employed to solve both steady and transient axisymmetric flow problems in porous media. The problems analyzed here are governed by Laplace's equation; however, the unsteady and nonlinear behavior result from the presence of a free surface. Both finite and infinite domains are easily handled with the BIEM. Results were presented for a variety of well and recharge problems. Comparisons of BIEM results to a linearized theory showed excellent agreement for recharge problems where the linearized theory is valid. In addition, results were obtained for cases where the linearized theory cannot be used. The BIEM solution for steady state well problems were in excellent agreement with solutions obtained by a finite element method, as well as the analytic solution using the Dupuit assumption. Finally, the BIEM yields solutions to a variety of transient well problems. It was concluded that the BIEM is both an accurate and efficient method for solving well and recharge problems. (See also W80-02161) (Visocky-ISWS)
W80-02162

ASSESSING PUBLIC GROUND-WATER SUPPLIES IN ILLINOIS,
Illinois State Water Survey, Urbana. Hydrology Section.
A. P. Visocky, and H. A. Wehrmann.
Ground Water, Vol 17, No 6, p 538-543, November-December 1979. 3 Fig, 2 Ref.

Descriptors: *Aquifers, *Groundwater, *Water supply, *Illinois, Water demand, Assessments, Wells, Water wells, Pumping, Groundwater resources, Water yield, Public utilities, Data processing, Data collections, Water supply adequacy, Public groundwater supplies.

Illinois aquifers furnish approximately 233 mgd (10.2 cu m/s) of water to 677 public water supplies outside the six-county area of northeastern Illinois. Groundwater is usually obtained from sand and gravel deposits in the glacial drift or from limestone or sandstone formations in the underlying bedrock. The most favorable groundwater conditions are found in the northern third and the southern tip of the State, while, elsewhere, major aquifers are sand and gravel deposits of the Mississippi, Illinois, buried Mahomet, Wabash, Ohio, Kaskaskia, and Embarrass valleys. A brief review was made of data and information in the State Water Survey files for each public groundwater supply, and an assessment was given as adequate, marginal, or deficient in terms of present demands. Twenty-four supplies were studied in greater detail, including calculations of aquifer sustained yields. The study indicated that 39 supplies were marginal and four were judged deficient in meeting current demands. The majority of the marginal and deficient supplies are located in the central third of the State; but so are most of the supplies (outside of northeastern Illinois). The study represented the

first of a three-part plan: (1) to define problem areas and determine priorities for studies in greater detail, (2) to conduct regional studies, including test drilling, in problem areas to determine how great the water resource is, and (3) to determine the water resource alternatives available to public groundwater supplies that are found to be inadequate. (Sims-ISWS)
W80-02170

GROUND-WATER POLLUTION BY TRANSFER OF OIL HYDROCARBONS,
Strasbourg Univ. (France). Inst. de Mecanique des Fluides.
For primary bibliographic entry see Field 5B.
W80-02173

USEFULNESS OF WELL REGISTRATION DATA,
Nebraska Univ., Lincoln. Dept. of Geology.
D. T. Pederson.
Ground Water, Vol 17, No 6, p 604-607, November-December 1979. 5 Fig, 4 Ref.

Descriptors: *Groundwater, *Transmissivity, *Water wells, *Data collections, *Nebraska, Drawdown, Pumping, Water yield, Maps, Mapping, Geology, Hydrogeology, Data processing, Analytical techniques, Well registration, Well registration data.

This investigation was to determine whether data on irrigation-well registration forms as reported by well drillers can be used in hydrologic studies. Transmissivity maps were prepared for Hamilton County, Nebraska, using only specific capacity values computed from yield and drawdown data, as reported on irrigation well-registration forms. On one map, each control point was the mean of the transmissivity values calculated for all wells in a section. On a second map, each control point was the mean of the means for fourt contiguous sections sharing a common corner. The second map was similar to that of a previously prepared map based on control point values computed from specific capacities of selected wells, test hole logs, and geologic interpretations. These results suggest that reported registration data for a given area have a normal population distribution. In situations where individual data are unverified, the data base can be treated as samples of a population where the mean of the means of several samples for adjacent areas is representative of actual field conditions. (Sims-ISWS)
W80-02174

OBSERVATIONS OF A POTENTIAL SIZE EFFECT IN EXPERIMENTAL DETERMINATION OF THE HYDRAULIC PROPERTIES OF FRACTURES,
California Univ., Berkeley. Lawrence Berkeley Lab.
P. A. Witherspoon, C. H. Amick, J. E. Gale, and K. Iwai.
Water Resources Research, Vol 15, No 5, p 1142-1146, October 1979. 6 Fig, 1 Tab, 9 Ref. USGS 14-08-0001-14583, NSF GK-42776, DOE W-7405-ENG-48.

Descriptors: *Fractures(Geologic), *Hydraulic properties, *Hydraulic conductivity, Laboratory tests, Rocks, Cores, Stress, Permeability, Fracture permeability, Groundwater, Groundwater movement, Radioactive wastes, Data processing, Analytical techniques, Hydrology, Size effects, Specimen size.

In several recent investigations, experimental studies on the effect of normal stress on the hydraulic conductivity of a single fracture were made by using three rock specimens ranging in cross-sectional area from 0.02 sq m to over 1 sq m. At the maximum stress levels that could be attained (10-20 MPa), minimum values of the fracture hydraulic conductivity were not the same for each rock specimen. These minimum values increased with specimen size, an indication that the determination of fracture conductivity may be significantly influenced by a size effect. The implications of these results are important. Cores collected in the field are normally not larger than 0.15 in diameter. However, the results of this work suggested that when a core of this size is used for laboratory investigations, the results may be nonconservative in that fracture permeabilities will be significantly lower than those that will be found in the field. If the results with an ultralarge core (0.95 m in diameter) are more indicative of field conductivities for a fracture under stress, then further work is needed to determine optimum specimen size so that reliable results on flow in fractures under stress will be available. (Sims-ISWS)
W80-02175

INDUCED GROUNDWATER RECHARGE IN THE GANGES BASIN,
Indian Inst. of Tech., New Delhi.
For primary bibliographic entry see Field 4B.
W80-02176

PROGRAMMABLE HAND CALCULATOR PROGRAMS FOR PUMPING AND INJECTION WELLS: I–CONSTANT OR VARIABLE PUMPING (INJECTION) RATE, SINGLE OR MULTIPLE FULLY PENETRATING WELLS,
Missouri Univ. Rolla. Dept. of Geological Engineering.
D. L. Warner, and M. G. Yow.
Ground Water, Vol 17, No 6, p 532-537, November-December 1979. 1 Tab, 7 Ref, 3 Append. EPA R-805039-01-0

Descriptors: *Water wells, *Injection wells, *Computer programs, Equations, Mathematical models, Hydraulic properties, Transmissivity, Storage, Porosity, Pressure, Pumping, Wells, Aquifers, Groundwater, Hand calculators.

Small programmable calculators have recently become available that will allow many routine pumping or injection well calculations to be made rapidly, accurately, and inexpensively. Programs and example calculations were given for the exponential integral and multiple well-multiple rate pumping or injection well equations using water well and oilfield units. The programs were for the TI 59 card programmable calculator. (Sims-ISWS)
W80-02183

UNSATURATED FLOW BENEATH TAILINGS IMPOUNDMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. B. McWhorter, and J. D. Nelson.
Journal of the Geothechnical Engineering Division, American Society of Civil Engineers, Vol 105, No GT 11, Proceedings Paper 14999, p 1317-1334, November 1979. 7 Fig, 19 Ref, 1 Append.

Descriptors: *Impoundments, *Seepage, *Dams,* Unsaturated flow, *Mining, Mathematical models, Equations, Porous media, Hydraulic conductivity, Groundwater movement, Percolation, Phreatic lines, Linings, Clays, Darcys law, Embankments, *Tailings, Wetting front.

Using technology developed for flow through porous media for applications in other disciplines, equations were developed to permit computation of seepage rates from tailings impoundments. Seepage was shown to take place in three distinct stages. The first stage comprises a period during which a wetting front progresses downward from the impoundment. The second stage commences when the wetting front contacts either a phreatic surface or an impermeable boundary. The third stage begins when the groundwater mound contacts the bottom of the impoundment. During the third stage, flow occurs laterally away from the area beneath the impoundment. Example computations were presented for an impoundment with and without a liner. Particular conclusions regarding the variation of seepage rates depend on the boundary condtions of the situation being analyzed. Seepage rates increase almost linearly during the first two stages and decrease after the third stage has been reached. (Visocky-ISWS)
W80-02195

MODEL EVALUATION OF THE HYDROGEOLOGY OF THE CYPRESS CREEK WELL FIELD IN WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6A.
W80-02236

POTENTIOMETRIC MAP OF THE PALEOZOIC AQUIFER IN NORTHEASTERN MISSISSIPPI, OCTOBER AND NOVEMBER 1978,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Geological Survey Water-Resources Investigations 79-71 (open-file report), 1979. 1 Sheet, 5 Ref.

Descriptors: *Subsurface mapping, *Groundwater, *Water levels, *Potentiometric level, Water supply, Water wells, Observation wells, Aquifer characteristics, Groundwater resources, Mississippi, *Tishomingo County(Miss).

The Paleozoic rocks that outcrop in Tishomingo County, Mississippi, supply water to public, industrial, and domestic wells in two counties in the northeastern part of the State. Paleozoic rocks in the area consist mostly of beds of sandstone, shale, and limestone which dip about 30 feet per mile to the southwest. The potentiometric surface of the Paleozoic aquifer slopes generally to the west away from the area of outcrop and is strongly influenced by large ground-water withdrawals at Corinth. The water level at Corinth has declined about 140 feet since 1954. Pumping at Corinth has affected water levels in wells more than 10 miles from the center of pumping. (Woodard-USGS).
W80-02238

GEOLOGY AND GROUNDWATER RESOURCES OF WESTERN CRAWFORD COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
G. R. Schiner, and J. T. Gallaher.
Pennsylvania Geological Survey, Fourth Series, Water Resource Report 46, 1979. 103 p, 4 Fig, 3 Plates, 6 Tab, 31 Ref.

Descriptors: *Groundwater resources, *Hydrogeology, *Aquifer characteristics, *Water yield, *Water quality, Water wells, Well data, Water levels, Well casings, Geology, Stratigraphy, Groundwater availability, Groundwater recharge, Water analysis, Chemical analysis, Geologic mapping, Pennsylvania, *Western Crawford County(PA).

This report provides the necessary information on ground water (well water) to estimate with reasonable accuracy the casing requirements, potential yield, and quality of water yielded by wells drilled in western Crawford County, Pa. It should also help to understand why some wells are better than others nearby, even though they have the same depth. The report can be used as a guide by water managers, well drillers, and homeowners to help choose sites for maximum yield. The text contains a description of the aquifers (water-yielding rocks), data on depths and yields of wells, and information on the chemical quality of the ground water, and is accompanied by geologic maps and a well location map. (Woodard-USGS).
W80-02249

DETECTION METHODS FOR LOCATION OF SUBSURFACE WATER AND SEEPAGE,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
R. M. Koerner, J. S. Reif, and M. J. Burlingame.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 105, No GT 11, Proceedings Paper 14989, p 1301-1316, November 1979. 2 Fig, 2 Tab, 29 Ref, 1 Append. EPA R-80743.

Descriptors: *Dams, *Groundwater movement, *Seepage, *Measurement, *Non-destructive tests, On-site tests, Flow, Geophysics, Infrared radiation, Microwaves, Acoustics, Drainage, Tracers, Temperature, *Detection.

The problem of subsurface water and seepage location has classically utilized borings and interpolated information between them. Since high expenses can result and the intermittant information remain less than desirable, the search for a nondestructive test (NDT) method has attracted much attention. This paper presented a number of these NDT methods in outline form. Included was a review of detection methods based on flow measurement, tracers, temperature, infrared, microwave, geophysical, and acoustic emission sending schemes. A comparison of the methods and some generalized remarks concluded the paper. (Visocky-ISWS)
W80-02334

INFLUENCE OF WELL WATER QUALITY VARIABILITY ON SAMPLING DECISIONS AND MONITORING,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 5B.
W80-02356

THE IMPORTANCE OF SOIL IN EVALUATING POTENTIAL WASTE WATER DISPOSAL SITES IN THE MISSOURI OZARKS,
Missouri Univ., Columbia. School of Forestry, Wildlife and Fisheries.
For primary bibliographic entry see Field 2G.
W80-02357

2G. Water In Soils

USE OF INFILTATION EQUATION COEFFICIENTS AS AN AID IN DEFINING HYDROLOGIC IMPACTS OF RANGE MANAGEMENT SCHEMES,
Utah State Univ., Logan. Water Science Unit.
G. F. Gifford.
Journal of Range Management, Vol 31, No 2, p 115-117, March 1978. 4 Fig, 5 Ref. OWRT B-143-UTAH(2), 14-34-0001-7193.

Descriptors: *Infiltration, *Analytical techniques, Equations, *Soil physics, Soil water movement, Infiltrometers, Model studies, Mathematical models, Vegetation effects, Crop response, Pinyon-juniper, Utah, Range management.

The relationship between infiltration in rangeland plant communities and soil and vegetation characteristics has long been a subject of interest to hydrologists who have sought to express their results with specific models and equations. The purpose of the present study was to determine the relationship of selected rangeland vegetation characteristics and soil properties to the infiltration coefficients contained in three common infiltration equations; Horton's equation, Philip's equation and Kostiakor's equation. Data was collected using the Rocky Mountain infiltrometer on approximately 500 plots covering 13 pinyon-juniper (Pinus spp - Juniperus spp) plant communities scattered throughout Utah. Results indicated that Kostiakor's equation was related more to vegetation factors than to soil factors while Philip's equation was related more to soil factors than to vegetation factors. Horton's equation being intermediate between the two, represented vegetation and soil influences best. It is hoped that these results will be useful in determining long and short term temporal changes in infiltration rates as a function of specific management plans. (Tickes-Arizona)
W80-02146

SOIL HEAT TRANSDUCERS AND WATER VAPOR FLOW,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary.
Soil Science Society of America Journal, Vol 43, No 5, p 835-839, September-October 1979. 5 Fig, 2 Tab, 9 Ref, 1 Append.

Descriptors: *Thermal conductivity, *Water vapor, *Soil water, *Laboratory tests, Heat transfer, Soils, Equipment, Laboratory equipment, Moisture content, diffusivity, Temperature, Soil temperature, Soil science, Water vapor flow.

The heat flow through a silt loam, silty clay, and loamy sand was measured in a calorimeter at 7 and 36C under matrix potentials near -0.3 bars. The transient thermal conductivity probe, the heat flux transducer, and deVries's theoretical method all gave low values of the apparent thermal conductivity at 36C. An empirical correction was proposed for deVries's method that improved its agreement with the observed conductivities. The thermal vapor diffusion coefficients for the three soils were then calculated from this equation and comared with experimental values from the calorimeter. It was also shown that the thermal water vapor flow can be estimated if one knows the soil's saturated thermal conductivity, quartz content, water content, bulk density, and temperature distribution. (Sim-ISWS)
W80-02163

FLUX-CONTROLLED SORPTIVITY MEASUREMENTS TO DETERMINE SOIL HYDRAULIC PROPERTY FUNCTIONS,
Science and Education Administration, Riverside, CA. Salinity Lab.
C. Dirksen.
Soil Science Society of America Journal, Vol 43, No 5, p 827-834, September-October 1979. 10 Fig, 55 Ref.

Descriptors: *Sorption, *Hydraulic conductivity, *Diffusivity, *Laboratory tests, Equations, Functions, Mathematical models, Infiltration, Gamma, Soil moisture meters, Equipment, Laboratory equipment, Soil water, Moisture content, Methodology, Soil science.

Using a new method, the hydraulic diffusivity and conductivity functions D(theta) and K(h) can be determined over most of their range in about 4 hours. This method uses a series of fast and simple, one-dimensional, absorption measurements for which the cumulative volumes of absorption are controlled proportional to the square root of time with syringes driven by cams. Each combination of motor speed, cam size, and syringe size represents an imposed sorptivity for which the water content and/or pressure head at the interface must be measured after they become steady. Steady values are normally reached after only a few minutes. Pressure heads can be recorded during the absorption runs, and at the end, a soil sample for gravimetric water content determination can be obtained in about 15 sec. Hydraulic diffusivity and conductivity functions derived from measured sorptivity functions were obtained for a variety of undisturbed and handpacked soil columns. They all showed excellent agreement with independent data. The flux-controlled boundary resulted in uniform wetting almost every time, whereas previously used potential-controlled boundary conditions often caused nonuniform wetting, which prevented accurate evaluation of sorptivities. The speed, range, and accuracy of this improved version of the sorptivity method compared favorably with other available methods. The method is suitable for routine and large-scale use. (Sims-ISWS)
W80-02164

TRANSPORT OF INORGANIC PHOSPHORUS IN AN ALFISOL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
O. A. de Camargo, J. W. Biggar, and D. R. Nielsen.
Soil Science Society of America Journal, Vol 43, No 5, p 884-890, September-October 1979. 5 Fig, 3 Tab, 26 Ref.

Descriptors: *Phosphorus, *Soils, *Soil water *Pore water, Movement, Flow, Soil water movement, Adsorption, Particle size, Pores, Laboratory tests, Numerical analysis, Mathematical models, Model studies, Phosphates, Nutrients, Soil science.

Absorption, desorption, and movement of phosphorus in an Alfisol soil were characterized by miscible-displacement and batch-type experiments. The influence of pore-water velocity, aggregate size, and pretreatment of the soil with P was evaluated. A model which considers the interaction of P with soil as an equilibrium kinetic process was utilized to differentiate between instantaneous and time-dependent reactions which appear to govern the adsorption-desorption process during displacement. Pore-water velocity has a greater influence on the adsorption rather than the desorption process which appeared to be more chemically controlled. Aggregate size affected the time-dependent more than the instantaneous processes of soil-P interaction. Instantaneous reactions between P and soil were shown to be mitigated by pretreatment of the soil with P in contrast to time-dependent reactions. A pore model was hypothesized to explain the differential uptake and release of P during displacement. (Sims-ISWS)
W80-02165

PARTICLE SIZE ANALYSIS BY HYDROMETER: A SIMPLIFIED METHOD FOR ROUTINE TEXTURAL ANALYSIS AND A SENSITIVITY TEST OF MEASUREMENT PARAMETERS,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resource Dept.
G. W. Gee, and J. W. Bauder.
Soil Science Society of America Journal, Vol 43, No 5, p 1004-1007, September-October 1979. 2 Fig, 3 Tab, 12 Ref. DOE JM-05-0103.

Descriptors: *Particle size, *Soils, *Sediments, *Hydrometers, Analytical techniques, Laboratory tests, Methodology, Sands, Clays, Sedimentation, Soil science, Clay determination, Mechanical analysis.

A simple modification of the Day hydrometer method was suggested for routine textural analysis. The simplified method requires no calibration, graphs, or tables and uses a weighted average of the 1.5-hour and 24-hour readings to determine the 2 micrometer clay fraction. The equation was found to be satisfactory in the range of summation percentage for the 2 micrometer clay fraction between 5% and 60% by weight for over 70 North Dakota soil and subsoil materials when the weighting factor was 0.876. Sensitivity analyses were performed for the Day, Bouyoucos, and the Simplified Day hydrometer methods to determine which of several measured parameters contribute to the greatest possible error; and hence, which parameters should be controlled with the greatest precision. The hydrometer scale reading error contributes more error than any other single parameter. (Sim-ISWS)
W80-02166

DISTRIBUTION AND PROPERTIES OF SOME TIDAL MARSH SOILS OF APALACHEE BAY, FLORIDA,
Florida Agricultural and Mechanical Univ., Tallahassee. Dept. of Earth and Plant Science.
C. L. Coultas, and E. R. Gross.
Soil Science Society of America Proceedings, Vol 39, No 5, p 914-919, September-October, 1975. 3 Fig, 4 Tab, 26 Ref.

Descriptors: *Soils, *Tidal marshes, *Florida, Wetlands, Marshes, Physical properties, Chemical properties, Conductivity, Sulfur, Hydrogen ion concentration, Cation exchange.

Three pedons representative of the major soils were described and sampled. The range of electrical conductivity is from 14 to 90 mmhos/cm. Field moist pH ranges from 5.6 to 7.8 and air dried pH values are 2 to 3 pH units lower. Content of S is less than 0.75 percent in the Psammaquents and Haplaquods to 6.8 percent in the Sulfaquents. Oxidation of S to sulfates was probably responsible for the increase of soil acidity after drying. Cation exchange capacity ranges from 2 to 25 meq/100 g for the Psammaquents and Haplaquods and from 25 to 75 meq/100 g for the Sulfaquents. Most soils are nearly base saturated. The soils classified in order of increasing elevation are members of the coarse-loamy, mixed, thermic Typic Sulfaquents; the sandy, siliceous, thermic Mollic Psammaquents; and the sandy, siliceous, thermic Aeric Haplaquods. Because of high potential acidity, low bearing strength, and high salinity, decisions concerning man's use of tidal marsh soils should be carefully made. Undisturbed, these are productive

soils performing functions valuable to man. (Stihler-Mass)
W80-02313

GROWTH OF PHRAGMITES COMMUNIS TRIN., TYPHA LATIFOLIA L., AND TYPHA ANGUSTIFOLIA L. IN RELATION TO THE FERTILITY OF SOILS,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
For primary bibliographic entry see Field 2I.
W80-02330

A THERMAL CONDUCTIVITY PROBE DESIGNED FOR EASY INSTALLATION AND RECOVERY FROM SHALLOW DEPTHS,
Geological Survey, Lawrence, KS.
M. Sophocleous.
Soil Science Society of America Journal, Vol 43, No 5, p 1056-1058, September-October 1979. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Thermal conductivity, *Equipment, *Instrumentation, Electrical equipment, Sampling, On-site investigation, Soils, Soil water, Soil science, Thermal conductivity probes.

Existing designs of thermal conductivity probes were modified in order to build a probe suitable for easy installation and recovery from shallow depths above or below the water table in unconsolidated deposits. The performance of the thermal conductivity probe described here was compared to a recent probe design with satisfactory results; it was also successfully tested in the field. (Sims-ISWS)
W80-02348

COMPARISON OF VARIOUS METHODS OF SAMPLING SOIL WATER FOR DETERMINING IONIC SALTS, SODIUM, AND CALCIUM CONTENT IN SOIL COLUMNS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
K. A. Barbarick, B. R. Sabey, and A. Klute.
Soil Science Society of America Journal, Vol 43, No 5, p 1053-1055, September-October 1979. 1 Fig, 4 Tab, 12 Ref.

Descriptors: *Soils, *Soil water, *Salts, *Sewage effluents, Sampling, Laboratory tests, Ions, Sodium, Calcium, Leaching, Leachate, Sewage, Sludge disposal, Porous ceramic cups, Soil columns.

At the end of a column experiment studying the flux of ionic salts and Na(+) from applied sewage effluent, the salt, Na(+), and Ca(2+) contents were compared in extracts from porous cups, from the soils around the cups, and from saturated paste extracts after the column soils were air-dried. The salt level in the porous cup samples and in the moist soil samples obtained directly at the end of the experiment, and the Na(+) content in the porous cup and in saturated paste extracts that were equilibrated for 48 hours were highly correlated. (Sims-ISWS)
W80-02349

HYDRODYNAMIC DISPERSION DURING INFILTRATION OF WATER INTO SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
D. E. Elrick, K. B. Laryea, and P. H. Groenevelt.
Soil Science Society of America Journal, Vol 43, No 5, p 856-865, September-October 1979. 6 Fig, 4 Tab, 13 Ref, 1 Append.

Descriptors: *Hydrodynamics, *Dispersion, *Infiltration, *Soil water movement, Percolation, Mathematical models, Moisture content, Numerical analysis, Chlorides, Computer programs, Equations, Unsaturated flow, Unsteady flow, Miscible displacement, Computer simulation program.

The analysis of hydrodynamic dispersion during one-dimensional sorption of water by soil (horizontal flow) was extended to include the gravitational effects present during one-dimensional infiltration (vertical flow). A power series form for the solution was developed in a manner similar to that developed by Philip for water movement during infiltration. Similar to the sorption analysis, the longitudinal dispersion coefficient was assumed to be a function of water content only. A computer simulation program using CSMP was used to solve the associated differential equations. A single program was found to be suitable as long as the Boltzman parameter (distance divided by the square root of time) was used as the independent variable throughout. An algorithm was developed to give successively better solutions of the soil water diffusion and hydrodynamic dispersion equations. Infiltration experiments were carried out on a clay loam soil. Both the water and chloride content profiles preserved similarity in terms of the Boltzman parameter. Water and solute coefficients of the power series solutions were calculated from horizontal infiltration and hydraulic conductivity data and were used to predict both the water and solute profiles during vertical infiltration. Good agreement between the vertical infiltration data and the theoretical predictions was obtained. (Visocky-ISWS)
W80-02350

A NUMERICAL STUDY OF THE EFFECTS OF NONCAPILLARY-SIZED PORES UPON INFILTRATION,
Science and Education Administration, Coshocton, OH. North Appalachian Experimental Watershed.
W. M. Edwards, R. R. van der Ploeg, and W. Ehlers.
Soil Science Society of America Journal, Vol 43, No 5, p 851-856, September-October 1979. 7 Fig, 2 Tab, 41 Ref.

Descriptors: *Numerical analysis, *Soil water movement, *Unsaturated flow, *Infiltration, Pores, Runoff, Mathematical models, Hydraulic conductivity, Capillary action, Annelids, Worms, Channels, Tubes, Hydraulic properties, Surface-connected channels, Radial flux from holes, Large pore continuity.

A numerical solution to the unsaturated soil moisture flow equation was used to model infiltration into a soil containing surface-connected noncapillary holes. Input parameters used to demonstrate the model were those from an untilled silt loam soil whose infiltration characteristics are strongly influenced by worm holes, especially when rainfall rates are high. The two-dimensional model allows for vertical infiltration from the soil surface and for lateral infiltration from a vertical hole after excess precipitation on the surface runs into the hole. The model shows that the number of holes per unit soil area, as well as the diameter and depth of the holes, greatly influence infiltration and surface runoff. The assumption of noncapillary flow through continuous holes or cracks may be used to explain some of the observed deviations from capillary flow theory and the fast movement of surface-applied agricultural chemicals through the soil profile. (Visocky-ISWS)
W80-02351

THE USE OF A TRANSFORMED BOUNDARY CONDITION IN MODELLING AIR COMPRESSION DURING INFILTRATION,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
K. K. Watson, and A. A. Curtis.
Soil Science Society of America Journal, Vol 43, No 5, p 848-850, September-October 1979. 2 Fig, 9 Ref.

Descriptors: *Infiltration, *Air, *Soil water, *Numerical analysis, Model studies, Mathematical models, Boundary processes, Unsaturated flow, Hysteresis, Soils, Porous media, Pressure, Soil science.

A computer-based numerical analysis incorporating a time-dependent surface boundary condition transformation is of value in modelling the air compression effects which occur during ponded infiltration in bounded columns. However, the transformation requires clarification when used with materials which exhibit a well-defined water entry value. Since the capillary pressure head has no meaning in the saturated zone, which develops from the surface downwards during the infiltration process, it is necessary to define a pseudocapillary pressure head for this zone. This concept assists in developing a consistent qualitative argument showing that the one-phase, one-dimensional analysis accurately models the bounded flow regime. The condition which governs the termination of the analysis upon air escape was also considered. (Sims-ISWS)
W80-02352

WATER VAPOR MOVEMENT IN SOIL: RECONCILIATION OF THEORY AND EXPERIMENT,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, and J. Letey, Jr.
Soil Science Society of America Journal, Vol 43, No 5, p 823-827, September-October, 1979. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Water vapor, *Soils, *Heat transfer, Soil moisture, Temperature, Soil temperature, Heat, Movement, Soil properties, Model studies, Theoretical analysis, Mathematical models, Assessments, Laboratory tests, Measurement, Thermal conductivity, Soil science, Water vapor movement.

A large number of separate experimental studies of water vapor movement in response to thermal gradients were shown to be independent of water content over a wide range of water contents. Two models were rewritten in a compatible form and compared to the data. The phenomenological model of Cary describes the data if the phenomenological coefficient Beta has a value between 1 and 3.5, whereas the mechanistic theory of Philip and de Vries underpredicts the vapor transport observed in the experiments in all cases. A modification of the theory of Philip and de Vries was proposed which increases the influence of liquid water on vapor transport. In the new formulation, the experimental information was adequately described, and both models were rendered compatible. Both experimental and theoretical results suggested that water vapor movement may be described by a simple expression which is a known function of temperature, and is independent of water content over a wide range of saturation. Even without calibration it was suggested that this expression can describe water vapor flux to within a factor of 2. (Sims-ISWS)
W80-02353

THE IMPORTANCE OF SOIL IN EVALUATING POTENTIAL WASTE WATER DISPOSAL SITES IN THE MISSOURI OZARKS,
Missouri Univ., Columbia. School of Forestry, Wildlife and Fisheries.
C. D. Settergren, and L. C. Tennyson.
Water Resources Bulletin, Vol 15, No 5, p 1353-1364, October 1979. 5 Fig, 14 Ref.

Descriptors: *Sewage effluents, *Irrigation, *Nutrients, *Path of pollutants, *Missouri, Water pollution, Water pollution sources, Water chemistry, Soil water, Soil water movement, Neutron activation analysis, Nitrates, Calcium, Magnesium, Bromine, Tracers, Karst, Karst hydrology, Land application.

A number of criteria can be used in the selection of an area for the irrigation disposal of secondary treated wastewater. The inherent capacity of the surface soil to retain, or at least detain, the various nutrient ions passing through the profile in the percolating waters becomes the prime consideration in regions with shallow water tables or in karst areas such as the Missouri Ozarks where the risk of groundwater supply contamination is high. A comprehensive study of the nutrient renovation potential of several soils was undertaken at a proposed effluent irrigation site along the Ozark National Scenic Riverways in south central Missouri. The surface soil hydrology was evaluated employing selected soil water parameters. Exchange equilibria studies determined the retention capacity for Ca and Mg, while the concentrations of other selected ions were analyzed in the soil water to

measure their retention time and net removal. The movement of a bromine tracer was monitored as an index of the renovation capacity of these soils for the more mobile anions such as nitrate. Neutron activation analysis proved to be a useful tool in the water quality analyses. All surface soil profiles demonstrated some degree of nutrient renovation for the various nutrients studied. (Sims-ISWS)
W80-02357

2H. Lakes

DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF WATER MILFOIL IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
E. Chagnon, and A. L. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124290, Price codes: A06 in paper copy, A01 in microfiche. Water Resource Research Center. University of New Hampshire. Research Report No 23, 1979. 107 p, 33 fig, 60 ref. OWRT A-043-NH(2), 14-31-0001-6030.

Descriptors: *Plant tissues, *Aquatic plants, *Phosphorus, *Lakes, Plant growth, Vegetation, Vascular tissues, *Lake Winnipesaukee, *New Hampshire, *Phosphorus uptake, *Myriophyllum heteropyllum, Water milfoil, Phosphorus concentration.

Myriophyllum heteirophyllum Michx. has been described as the dominant aquatic vascular plant in the littoral of Lake Winnipesaukee, N.H. its distribution, throughout the lake, was mapped and its habitat preferences were noted. The plant is present in areas with a silt-sand substrate and low wave action at depths of 0.5 to 3 m. The density of the stands was determined at three sites. Rapid colonization and stand expansion occurred through vegetative reproduction. Tissue phosphorus levels of M. heterophyllum varied seasonally during 1975-1976 and reached a maximum of 0.75% dry weight during late May. A correlation between tissue phosphorus and sediment phosphorus was observed for the three study sites. In situ phosphorus enrichment of the water produced a marked increase in tissue phosphorus of M. heterophyllum. Growth of the plants occurred from April through October with the maximum growth rate (June through August) at more than 1.5 cm/day. In batch culture tissue phosphorus levels of shoot apices are proportional to phosphorus levels in the medium. Luxury consumption of phosphorus was evident. Two uptake mechanisms appeared to function in phosphorus uptake. In culture both uptake and growth were affected by temperature, while growth rate was not affected by the phosphorus concentration in the medium. Phosphorus was released from decaying plants.
W80-02154

PHYSICAL AND CHEMICAL WATER QUALITY CHARACTERISTICS OF THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5E.
W80-02167

SYNTHETIC HYDROLOGIC INFORMATION--A CASE STUDY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2E.
W80-02185

TEMPERATURE STRUCTURE IN LARGE BODIES OF WATER, ANALYTICAL INVESTIGATION OF TEMPERATURE STRUCTURE IN LARGE BODIES OF STRATIFIED WATER,
National Research Council of Ottawa (Ontario). Hydraulics Lab.
M. Rahman.
Journal of Hydraulic Research, Vol 17, No 3, p 207-215, 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Thermal stratification, *Water temperature, *Mathematical studies, *Reservoirs, Analytical techniques, Theoretical analysis, Model studies, Lakes, Mathematical studies, Meteorological data, Heating, Spatial distribution, Heat transfer, Thermocline, Two layer model.

This article presented a two layer mathematical model for water temperature prediction in stratified reservoirs. The model included the nonlinear effects of the physical properties of water and the heat budget which accounts for vertical motion of the water body. A sensitivity analysis was performed with respect to the linear and nonlinear effects of the physical properties of water. Temperature profiles were determined by considering variable density, conductivity, and diffusivity, taking into account the influence of vertical motion of water but neglecting the effects of horizontal currents. Solution of the differential equation was effected by a similarity technique and applied to numerical problems. An analysis of profiles calculated under various assumptions indicated the importance of the major parameters. It also showed that neglecting the variation of physical properties with respect to temperature leads to significant differences in temperature profiles. (Humphreys-ISWS)
W80-02191

DISTRIBUTION, RESIDENCE TIME, AND FLUXES OF TETRACHLOROETHYLENE AND 1,4-DICHLOROBENZENE IN LAKE ZURICH, SWITZERLAND,
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschut Zurich (Switzerland).
For primary bibliographic entry see Field 5B.
W80-02193

THE EFFECTS OF MOWING ON THE DYNAMICS OF QUANTITY, BIOMASS AND MINERAL CONTENTS OF REED (PHRAGMITES COMMUNIS TRIN.),
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 6G.
W80-02318

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

THE INUNDATION ZONE OF THE NIGER AS AN ENVIRONMENT FOR PALAEARCTIC MIGRANTS,
Center for Overseas Pest Research, London (England).
For primary bibliographic entry see Field 2I.
W80-02328

2I. Water In Plants

DISTRIBUTION, GROWTH, AND PHOSPHORUS RELATIONSHIPS OF WATER MILFOIL IN LAKE WINNIPESAUKEE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 2H.
W80-02154

HALOPHYTES FROM COASTAL SALT MARSHES: A POTENTIAL SOURCE OF CROP PLANTS FOR ARID LANDS,
Delaware Univ., Newark. Coll. of Marine Studies.
G. F. Somers, M. Fontes, and D. M. Grant.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 402-417, July 1979. 4 Tab, 52 Ref.

Descriptors: *Halophytes, *Plant groupings, *Salt tolerance, *Crop response, *Plant breeding, *Soil-water-plant relationships, Saline soils, Saline water, Salt marshes, Saltbush, Saltgrass, Soil management(Applied), Environmental effects, Plant growth, Germination, Growth chambers, Varieties.

In the past the emphasis in salt-affected, arid region crop production has been on soil and water management with the view that there is little prospect of increasing the salt tolerance of conventional crops by breeding and selection. This paper, however, reports some efforts being made to select commercially useful plants which are highly salt tolerant, some of which might have potential as crops for arid lands. Seeds, collected mostly from tide marshes of estuaries along the eastern U.S. and the northern Gulf of California, were subjected to germination tests and grown in growth chambers, an illuminated room, or in the field and periodically flooded with saline water. More than 350 selections of over 60 species were evaluated by their vigor of growth in saline habitats, yield of fruit or other edible portion, general characteristics of edible portion, quality of fruit or edible portion, and potential for adapting to commercial production. The preliminary selection of a limited number of species that appear to merit further evaluation which resulted is discussed here according to family groups. (Tickes-Arizona)
W80-02198

THE EFFECTS OF WATER STRESS ON PHENOLOGY AND CARBOHYDRATE STORAGE IN THE SHORTGRASS PRAIRIE,
Science and Education Administration, Tucson, AZ.
J. R. Cox, and H. G. Fisser.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 529-537, July 1979. 2 Tab, 2 Fig, 18 Ref.

Descriptors: *Phenology, *Soil-water-plant relationships, *Plant morphology, *Environmental effects, *Moisture, Biochemistry, Nutrient requirements, Root systems, Seeds, Leaf water potential, *Carbohydrates, Soil texture, Plant groupings, Varieties, Roots, Stress, Wyoming.

This study was conducted in 1976 in Gillette, Wyoming, to determine the seasonal variation in leaf water potential (LWP), phenological development, and total nonstructural carbohydrates (TNC), and how various soil textural groups affected plant water use, morphology, and storage of nutrients in 2 important range forage species of the short-grass prairie region; western wheat grass (Agropyron smithii) and blue grama (Bouteloua gracilis). Individual plants of both species were selected bi-weekly during the growing season from 9 study areas; 3 of which were located on an area to be surface mined, 3 on sandy loams soils, and 3 on fine-textured loamy soils, on the basis of 4 criteria: phenological stage, basal diameter, height, and general appearance. Results indicated that LWP, phenological development, and TNC were similar on all soil types for both species of grass. Root reserves were found to be lowest on June 15 for western wheat grass with the elongation of leaves, whereas LWP was highest. Reserves were rapidly accumulated in early July, reaching maximum levels with the initiation of flowering. LWP increased during the following sampling period, whereas the level of reserves increased. Plants on loamy soils matured earlier during late July, while individuals on sandy soils matured more rapidly in late August, and reserves in blue grama gradually increased as LWP increased in all soils types. Seed formation, generally constant on soil types, matured slightly earlier on clayey soils. (Tickes-Arizona)
W80-02199

GUAR SHOWS POTENTIAL AS DROUGHT-TOLERANT SUMMER CROP FOR ARIZONA GRAIN FARMERS,
R. Dennis, and G. Webster.
Progressive Agriculture in Arizona, Vol 30, No 2,

p 10-11, Summer 1979.

Descriptors: *Crop response, *Drought tolerance, *Guar, *Seeds, *Irrigation practices, Agronomic crops, Legumes, Gum, Forages, Seasonal.

Summer-planted drought-tolerant guar (Cyanopsis peoralioides), a legume grown for forage and for its seeds which produce a gum used as a thickening agent and as a sizing material for paper and textiles, is gaining increased attention as a profitable annual crop to follow small grains harvested in May or June in the lower desert valleys of Arizona. Guar is also useful as an aflatoxin-free high protein feed. Irrigation management appears to be the key to success with this crop as grown on experimental plots in Arizona where an excess of 1500 pounds of seeds have been produced with as little as 18 inches of applied water. While most of the guar gum used in the U.S. is presently imported from India and Pakistan, Arizona researchers and extension agents see excellent potential for producing high quality guar locally in the near future. (Tickes-Arizona)
W80-02202

VEGETATIONAL RESPONSE TO THREE ENVIRONMENTAL GRADIENTS IN THE SALT PLAYA NEAR GOSHEN, UTAH COUNTY, UTAH,
Army Engineers District, New Orleans, LA.
M. G. Skougard, and J. D. Brotherson.
The Great Basin Naturalist, Vol 39, No 1, p 44-58, March 30, 1979. 4 Fig, 5 Tab, 4 Ref.

Descriptors: *Saline soils, *Salts, *Environmental effects, *Playas, *Plant groupings, *Soil moisture, *Environmental gradients, *Soil-water-plant relationships, Ecology, Varieties, Plant growth regulators, Frequency analysis, Soil physical properties, Correlation analysis, Niches, Biological communities, Utah, Hydrogen ion concentration.

Reported here are the results of a study to determine the response of both plant communities and individual species in and around a salt playa at the southern end of Utah Lake, south of Goshen Bay in Central Utah, to gradients of soluble salts, soil moisture and pH, the most crucial factors limiting plant growth in arid regions. Forty-eight 10 x 10 m study plots of homogenous vegetation were sampled within major vegetation zones and eight meter-square quadrants located at random within each plot were analysed through frequency and soil sample data to establish environmental gradients. Results indicated that vegetational types could be segregated by differential response to the three gradients studied. Correlation analysis indicated that 45% of the variation found in plant diversity could be accounted for by these 3 parameters with total soluble salts being the most influential. Niche width was found to exhibit no correlation to either of these gradients. (Tickes-Arizona)
W80-02205

THE EFFECTS OF A COAL FIRED POWER PLANT ON WETLANDS,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
For primary bibliographic entry see Field 5C.
W80-02259

WETLAND REHABILITATION,
Environmental Concern, Inc., St. Michaels, MD.
For primary bibliographic entry see Field 4A.
W80-02287

AQUATIC VEGETATION AND WATER POLLUTION CONTROL PUBLIC HEALTH IMPLICATIONS,
Texas State Dept. of Health, Austin.
For primary bibliographic entry see Field 5D.
W80-02298

GRADIENT ANALYSIS OF THE VEGETATION IN A BRACKISH MARSH IN BELLINGHAM BAY, WASHINGTON,
Western Washington Univ., Bellingham. Dept. of Biology.
D. J. Disraeli, and R. W. Fonda.
Canadian Journal of Botany, Vol 57, No 5, p 465-475, March 1, 1979. 6 Fig, 5 Tab, 31 Ref.

Descriptors: *Saltwater marsh, *Vegetation, *Ecological distribution, Aquatic plants, Marshes, Wetlands, Biomass, Soils, Physical properties, Streams, Deltas, Gradation, Water levels.

The islands in the delta of the Nooksack River support a brackish marsh with maximum salinity of 5.18 parts per thousand (ppt). On high tides, the marsh is flooded with water from the river rather than from Bellingham Bay. Marsh species were distributed according to combinations of elevation, length of tidal submergence, sand and silt content of the soil, and soil moisture. Two broad marsh zones were recognized. The Scirpus americanus marsh occurs below 274 cm above mean lower low water (MLLW), where it is submerged on nearly all high tides. It has over 70 submergence days per year. Soils are sandy but poorly drained, and aerial biomass is low. The Carex lyngbyei marsh occupies sites above 274 cm. This zone has fewer than 30 submergence days per year. These sites have siltier soils, better soil-moisture values, and greater biomass. (Howard-Mass)
W80-02299

THE ENVIRONMENTAL FATE OF THREE DICHLOROPHENYL NITROPHENYL ETHER HERBICIDES IN A RICE PADDY MODEL ECOSYSTEM,
Illinois Univ. at Urbana-Champaign. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W80-02301

PERSISTENCE AND FACTORS AFFECTING DISSIPATION OF MOLINATE UNDER FLOODED RICE CULTURE,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 5C.
W80-02302

SEASONAL DYNAMICS OF EPIPHYTIC ALGAL GROWTH IN A MARSH POND: COMPOSITION, METABOLISM, AND NUTRIENT AVAILABILITY,
Manitoba Univ., Winnipeg. Dept. of Botany.
N. M. Hooper-Reid, and G. G. C. Robinson.
Canadian Journal of Botany, Vol 56, No 19, p 2441-2448, October 1, 1978. 9 Fig, 20 Ref.

Descriptors: *Freshwater marshes, *Algae, *Growth, *Succession, *Nutrients, Nitrogen, Phosphorus, Silica, Chlorophyll, Standing crop, Rooted aquatic plants, Ponds, Chemical properties, Plant physiology, Canada.

Seasonal growth and succession of epiphytic algae on artificial substrates in a marsh pond were related to nutrient levels (N, P, and Si) and to various physiological indicators of nutrient availability, including chlorophyll content, protein to carbohydrate and lipid ratio, Si debt, storage phosphate levels, alkaline phosphatase activity, and nitrogenase activity. Low standing crops in June and early July coincided with indications of deficiency in terms of chlorophyll a content and protein to carbohydrate and lipid ratios at chosen Scirpus and Potamogeton sites. Low available N may have been limiting growth. In July and August, when available N, P, and Si were low, there was evidence of Si limitation of diatom growth at both sites. Growth of hererocystous, N2-fixing, blue algae and high alkaline phosphatase activity occurred in July at the Potamogeton site. Increased standing crop of epiphytic algae in September and October at the Scirpus site coincided with higher nutrient levels and an absence of deficiency symptoms. A delay in the standing crop increase at the Potamogeton site correlated with low nutrient levels and various physiological deficiency symptoms. (Howard-Mass)
W80-02303

AN IMPROVED, CONCEPTUALLY SIMPLE TECHNIQUE FOR ESTIMATING THE PRODUCTIVITY OF MARSH VASCULAR FLORA,
University of Southwestern Louisiana, Lafayette. Dept. of Biology.
C. T. Hackney, and O. P. Hackney.
Gulf Research Reports, Vol 6, No 2, p 125-129, December, 1978. 4 Fig, 14 Ref.

Descriptors: *Aquatic plants, *Productivity, *Statistical methods, Regression analysis, Wetlands, Marshes, Estimating equations, Ecology.

The estimation of the net primary productivity of marsh communities with a periodic maximum-minimum (PMM) technique has certain advantages over the long used maximum-minimum standing stock technique, but still retains the same conceptual simplicity. The final productivity estimate with PMM is based on the entire data set rather than just two points. Direct statistical comparisons between any two communities can be made. An estimate of the productivity by minor species in the community can also be made. The periodic model permits statistical comparisons about other variables in community growth such as the timing of the maximum standing crop. With certain assumptions, productivity estimates which account for the loss of live plant material during the growing season can be made without the tremendous amount of effort and time required by the Wiegert-Evans technique. Despite the increased utility the PMM technique requires no additional field effort. (Howard-Mass)
W80-02304

SEASONAL DYNAMICS OF EPIPHYTIC ALGAL GROWTH IN A MARSH POND: PRODUCTIVITY, STANDING CROP, AND COMMUNITY COMPOSITION,
Manitoba Univ., Winnipeg. Dept. of Botany.
N. M. Hooper-Reid, and G. G. C. Robinson.
Canadian Journal of Botany, Vol 56, No 19, p 2434-2440, October 1, 1978. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Freshwater marshes, *Algae, *Standing crop, *Productivity, Rooted aquatic plants, Wetlands, Marshes, Photosynthesis, Plant physiology, Ecology, Canada, Ponds.

The seasonal growth of epiphytic algae colonizing artificial cellulose acetate substrates positioned in a stand of Scirpus acutus Muhl. and in a zone of Potamogeton pectinatus L. in a marsh pond was quantified in terms of 14C photosynthetic uptake, cell volume, cell surface area, dry weight, and chlorophyll a, protein, carbohydrate, and lipid content. Standing crop and productivity increased at both sites in September and October, after generally low summer growth with the exception of the occurrence of heterocystous blue-green algae at the Potamogeton site in July. Factor analysis of interrelationships among the various parameters suggested that cell surface area was more directly related to productivity and various standing-crop parameters than was cell volume. (Howard-Mass)
W80-02305

ECOLOGIC AND PALEOECOLOGIC STUDIES IN THE FEIGNE D'ARTIMONT (VOSGES, FRANCE),
Utrecht Univ., (Netherlands). Lab. of Palaeobotany and Palynology.
C. R. Janssen, M. J. J. Cup-Uiterwijk, H. J. Edelman, J. Mekel-Te Riele, and J. P. Pals.
Vegetatio, Vol 30, No 3, p 165-178, August 20, 1975. 8 Fig, 3 Tab, 24 Ref.

Descriptors: *Bogs, *Palynology, *Vegetation, *Succession, *Geologic time, Wetlands, Swamps, Dating, France.

Pollen and macrofossil studies of cores in the raised bog part of a mire in the Vosges revealed an almost complete postglacial record. The major pollen assemblage zones, based upon features of the regional pollen types, have been described and their contacts dated by 14C dating. At 9000 BP a pine forest was replaced by mainly Corylus, and Quercus plus Ulmus migrated into the area. Tilia, Alnus and Acer arrived later. From 7500-5000 BP

forests of Corylus, Quercus, Tilia, Ulmus and Acer prevailed. Abies and Fagus are dominant in the vegetation from 5000 BP up to the present time. Carpinus immigrated around 3400 BP. In the present mire vegetation a number of vegetation types have been recognized and mapped. The local fossil assemblages have been compared with the species composition of present day plant communities. It is concluded that the raised bog part of the mire began its existence as a lake, that turned later into an intermediate fen (Caricion canescenti-fuscae). Ombrotrophic bog vegetation is present from 5000 BP on. (Howard-Mass)
W80-02306

PRODUCTIVITY AND COMPOSITION OF A BALDCYPRESS-WATER TUPELO SITE AND A BOTTOMLAND HARDWOOD SITE IN A LOUISIANA SWAMP,
Louisiana State Univ., Baton Rouge. Dept. of Marine Science.
W. H. Conner, and J. W. Day, Jr.
American Journal of Botany, Vol 63, No 10, p 1354-1364, November-December, 1976. 3 Fig, 5 Tab, 60 Ref.

Descriptors: *Primary productivity, *Forests, *Swamps, *Louisiana, Trees, Vegetation, Wetlands, Biomass, Ecology, Deciduous trees, Productivity.

The annual increase in stem biomass was 800 g dry wt/sq m for the bottomland hardwood site (BLH) and 500 g dry wt/sq m for the baldcypress-water tupelo site (CT). Litter-fall was 574 g dry wt/sq m for BLH and 620 g dry wt/sq m for CT. Harvest samples of herbaceous understory yielded 200 g dry wt/sq m and 20 g dry wt/sq m for BLH and CT, respectively. Minimum net primary production was calculated as the sum of the three; 1574 g dry wt/sq m/yr for BLH and 1140 g dry wt/sq m/yr for CT. Maximum estimates of herbaceous production and insect consumption were made by using values from the literature. Estimated total net primary productivity was 1733 g dry wt/sq m/yr for BLH and 1516 g dry wt/sq m/yr for CT. In bottomland hardwood areas, many woody species exist with Acer rubrum var. drummondii and Nyssa aquatica the most dominant. In the baldcypress-water tupelo, fewer woody species exist, and Taxodium distichum and N. aquatica dominated. (Stihler-Mass)
W80-02307

PEATLANDS,
Kings Coll., London (England). Dept. of Botany.
P. D. Moore, and D. J. Bellamy.
Elek Science, London, England. 1974. 221 p.

Descriptors: *Peats, *Wetlands, *Ecology, Aquatic life, Aquatic animals, Rooted aquatic plants, Chemical properties, Succession, Nutrients, Organic matter, Primary productivity, Microbiology, Ecosystems, Stratigraphy.

A summary of what is known concerning peatlands is presented in 10 chapters entitled: Geochemicals, Biogeochemicals and ecosystems; templates of peat formation; the geochemical template; mires--peat producing ecosystems; adaptation of mire organisms; peat stratigraphy--a record of succession; the microscopic components of peat; the world picture; the world's resource; and conservation. (Stihler-Mass)
W80-02310

THE EFFECT OF FLOODING ON LENGTH OF RESIDENCY IN THE WHITE-FOOTED MOUSE, PEROMYSCUS LEUCOPUS,
Illinois Univ. at Urbana-Champaign. Dept. of Zoology.
L. B. Blem, and C. R. Blem.
American Midland Naturalist, Vol 94, No 1, p 232-236, July, 1975. 3 Tab, 22 Ref.

Descriptors: *Mammals, *Rodents, *Flood plains, *Wildlife, Wetlands, Populations, Flooding, Vegetation.

White-footed mice, Peromyscus leucopus, remain on trapping grids longer on floodplains than on upland even though they are periodically subjected to flooding. Floodplain population levels ranged from 8.6 mice/ha (June) to 48.7 mice/ha (October). Upland populations fluctuated less and ranged from 2.2 mice/ha (April) to 23.2 mice/ha (October). The more dense herbaceous vegetation of the floodplain may provide food and protection from predation so that bottomland populations fare as well or better than their upland counterparts during years in which flooding is not severe. (Stihler-Mass)
W80-02311

DENSITY, BIOMASS, AND ENERGETICS OF THE BIRD AND SMALL MAMMAL POPULATIONS OF AN ILLINOIS DECIDUOUS FOREST,
Virginia Commonwealth Univ., Richmond. Dept. of Biology.
C. R. Blem, and L. B. Blem.
Transactions of the Illinois Academy of Science, Vol 68, No 2, p 156-164, 1975. 3 Tab, 20 Ref.

Descriptors: *Mammals, *Birds, *Flood plains, *Forests, Energy, Wildlife, Wetlands, Ecology, Biomass, Metabolism.

The population density, standing crop biomass, consuming biomass, diversity and standard metabolism of avian and mammalian communities were quantified over an annual cycle from studies of flood plain and upland forest plots in Hart Woods, Champaign County, Illinois. The flood plain bird and mammal populations each consistently had greater population density, standing crop biomass, consuming biomass and standard metabolism than their counterparts on the upland. Avian diversity was highest on the flood plain. Total annual minimal energy budgets are: floodplain mammals, 3,846 Mcal; flood plain birds, 3,371 Mcal; upland mammals, 2,684 Mcal; and upland birds, 2,214 Mcal. (Stihler-Mass)
W80-02312

MICHIGAN COASTAL WETLANDS: WHAT GOOD ARE THEY.
Booklet I, MICH U--SG--79--502, March, 1979. 6 p, 1 Fig. Michigan Sea Grant Communications, Ann Arbor, MI.

Descriptors: *Wetlands, *Coastal wetlands, *Michigan, Floods, Water quality, Wildlife, Fish, Agriculture, Recreation, Urbanization, Environmental impacts.

Michigan's coastal wetlands perform important ecological functions as natural water purification and flood control systems and provide habitats for fish and wildlife. Population pressures and increasing urbanization are forcing reassessment of land values, and there are pressures to use remaining wetlands for agricultural or recreational uses or for further urban development. (Stihler-Mass)
W80-02315

AN OVERVIEW OF ST. JOHN'S MARSH, ST. CLAIR COUNTY, MICHIGAN.
For primary bibliographic entry see Field 6G.
W80-02316

THE EFFECTS OF MOWING ON THE DYNAMICS OF QUANTITY, BIOMASS AND MINERAL CONTENTS OF REED (PHRAGMITES COMMUNIS TRIN.),
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
For primary bibliographic entry see Field 6G.
W80-02318

DEVELOPMENT OF PHRAGMITES COMMUNIS TRIN. DEPENDING ON THE AMOUNT OF AVAILABLE SOIL,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
W. Szczepanska.
Polskie Archiwum Hydrobiologii, Vol 24, No 3, p 311-318, 1977. 3 Fig, 5 Tab, 6 Ref.

Descriptors: *Marsh plants, *Plant growth, *Planting management, Wetlands, Vegetation establishment, Marsh management, Crop production, Density, Competition.

Experiments were conducted to determine the amount of soil indispensable for the unconstricted growth and development of Phragmites communis. It was found that the greater the amount of soil available the greater the weight of one shoot, the height and the number of the shoots produced, and the greater the biomass per square meter. Differentiation in height and the number of shoots occurred after about 70 days of culturing. The development of Phragmites under the conditions of competitive pressure is carried through by means of plastic adaptation to the biotope resources of the environment and by partial elimination of other individuals. Under the conditions of smaller amounts of soil, Phragmites plants exploit the available ground more thoroughly. (Steiner-Mass)
W80-02319

DEVELOPMENT OF THE UNDERGROUND PARTS OF PHRAGMITES COMMUNIS TRIN. AND TYPHA LATIFOLIA L.,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
W. Szczepanska.
Polskie Archiwum Hydrobiologii, Vol 23, No 2, p 227-232, 1976. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Marsh plants, *Cattails, *Growth stages, Wetlands, Biomass, Standing crop, Root development, Plant growth.

In the first weeks of Phragmites communis and Typha latifolia growth, the root/shoot ratio was 0.56 and 0.95, respectively. After 10 weeks of development, the ratio was 1.22 and 1.14. On September 1, the time of the maximum biomass of the aboveground parts of P. communis, the ratio was 1.85 and 1.13. On September 15, the time of the maximum biomass of the aboveground parts of T. latifolia, the ratio was 2.00 and 1.11. On October 1, a decrease in the biomass of the aboveground parts of P. communis was observed and at the same time the weight of the whole plant increased, indicating a further increase in the weight of the underground parts of the plant. A decrease in weight of the aboveground parts of T. latifolia was observed on October 15, and at that time the root/shoot ratio was 3.0 and 1.2. (Steiner-Mass)
W80-02320

WETLAND CLASSIFICATION IN WESTERN CANADA: A GUIDE TO MARSHES AND SHALLOW OPEN WATER WETLANDS IN THE GRASSLANDS AND PARKLANDS OF THE PRAIRIE PROVINCES,
Canadian Wildlife Service, Saskatoon(Saskatchewan).
For primary bibliographic entry see Field 6B.
W80-02321

MARYLAND USES NALED AGAINST SALT MARSH MOSQUITOES.
Pest Control, Vol 46, No 5, p 14, 16 and 18, May, 1978. 3 Fig.

Descriptors: *Mosquitoes, Insecticides, *Salt marsh, Wetlands, Pest control, Pesticides, Maryland, Insect control.

An experimental, 640-acre application of naled was performed on a Chesapeake Bay salt marsh to test its effects on mosquitoes and on selected non-target species. There was better than an 80 percent kill on mosquitoes and the mortality rate of non-target species was the same in both test and control areas. (Steiner-Mass)
W80-02322

ON THE RELATIVE DOMINANCE OF SHRUBS IN OKEFENOKEE SWAMP,
California Univ., Santa Barbara. Dept. of Biological Sciences.
W. H. Schlesinger.
American Naturalist, Vol 112, No 987, p 949-954,

September-October, 1978. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Shrubs,*Swamps, *Georgia, Wetlands, Vegetation, Aquatic plants, Productivity, Biomass, Burning, Ecology, Trees, Importance values.

Twenty-five random 2 x 2 m quadrants were sampled in each of 17 cypress forest stands. The shrub species in Okefenokee are those characteristic of southern acid bog environments. Most of the shrub layer biomass and productivity is comprised of the four shrub species which had the highest importance values (Itea virginica, Lyonia lucida, Leucothoe racemosa, Clethra alnifolia) and saplings of cypress and Nyssa sylvatica var. biflora. Total biomass in the shrub layer was 527 g/sq m; true shrub species accounted for 330 g/sq m. Density of shrub stems ranged from 14,900 to 42,800 stems/ha. The importance values for the shrubs in Okefenokee Swamp appear to be distributed according to MacArthur's broken-stick model. (Stihler-Mass)
W80-02323

HALOPHYTES: ADAPTIVE MECHANISMS,
W. H. Queen.
In: Physiological Ecology of Estuarine Organisms, F. J. Vernberg, editor, University of South Carolina Press, Columbia, S. C., p 205-211, 1975. 17 Ref.

Descriptors: *Aquatic plants, *Estuaries, *Salts, *Physiological ecology, Wetlands, Salinity, Plant morphology, Rooted aquatic plants, Salt balance, Ecology.

Major obstacles related to the presence of a high salt concentration which must be overcome if plant growth is to occur in an estuarine environment are: (1) acquisition of water from an external source with a high osmotic pressure; (2) maintenance of internal ionic balance; and (3) absorption of sufficient essential nutrients from a medium with an ionic mix unfavorable to higher plants. Halophytes have a variety of mechanisms for regulating their internal ionic balance and concentration including salt glands, shedding of salt-packed leaves, translocation of salt to roots and excretion into soil, and dilution by the development of succulent leaves. Mechanisms regulating salt absorption may prove to be more important than 'salt removal' techniques in controlling the internal ionic balance. Enzyme adaption may be an important factor in halophyte tolerance of high cellular salt concentrations. (Stihler-Mass)
W80-02324

DEVELOPMENT OF SOME LAKE ECOSYSTEMS IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE INVERTEBRATES,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
A. J. McLachlan.
Biological Review, Vol 49, p 365-397, 1974. 7 Fig, 2 Tab, 134 Ref.

Descriptors: *Lakes, *Succession, *Ecology, *Invertebrates, Wetlands, Rooted aquatic plants, Trees, Aquatic animals, Fish, Mud, Sediments, Chemical properties, Physical properties.

The giant man-made lakes, Kariba and Volta, provide the bulk of the data used for this review. The flooding of a lake basin initiates a series of changes leading eventually to a more stable climax situation after some years. The course of development appears to fall into two periods based on water level changes, the filling stage and the post-filling stage. The former is characterized by sudden appearances of organisms and explosive growths of animal and plant populations. Massive developments of large floating plants occur. During the post-filling phase the substrata are modified by the development of mud habitats under the influence of processes like sedimentation and beach formation, the development of submerged woodlands as habitats for bottom dwelling animals, the spread of rooted aquatic plants and fluctuations in water levels. Rooted plants may provide breeding nurseries for economically important fish species. (Stihler-Mass)
W80-02325

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

THE INUNDATION ZONE OF THE NIGER AS AN ENVIRONMENT FOR PALAEARCTIC MIGRANTS,
Center for Overseas Pest Research, London (England).
P. J. Curry, and J. A. Sayer.
Ibis, Vol 121, p 20-40, 1979. 7 Fig, 27 Ref, 1 Append.

Descriptors: *Niger River, *Flood plains, *Migratory birds, *Temporal distribution, Wetlands, Rivers, Africa, Waterbirds, Distribution patterns, Census, Waterfowl, Grasslands, Wildlife habitats.

Of at least 350 species recorded within the inundation zone, 108 (31%) are wholly or partially of Palaearctic origin. Five main habitats are recognized in the region: wetland, hygrophilous grassland, transition zone, non-flooded areas, and aerial. The habitats, the Palaearctic migrants and their possible competitors are described and discussed. The annual Niger flood regime enables Palaearctic waterbirds to find suitable habitats somewhere within the region during all seasons, but most widely during the autumn and winter months of the flood recession. Non-aquatic species inhabiting flood plain grasslands are scarce during the Palaearctic autumn becoming commoner and more diverse during the winter months. Wetland warblers of the genera Acrocephalus and Locustella have not been recorded on autumn passage. It is suggested that in some years at least, these and other trans-Saharan migrants from the West Palaearctic overfly the Sahelian latitudes of mid-west Africa. Species inhabiting the transition zone are most in evidence at the end of the winter period and during the spring hot, dry season, prior to northward trans-Saharan migration. Habitats and species encountered in the non-flooded areas are similar to those recorded in the Sahel zone elsewhere in West Africa. (Steiner-Mass)
W80-02328

GROWTH OF PHRAGMITES COMMUNIS TRIN., TYPHA LATIFOLIA L., AND TYPHA ANGUSTIFOLIA L. IN RELATION TO THE FERTILITY OF SOILS,
Polish Academy of Sciences, Warsaw. Inst. of Ecology.
W. Szczepanska, and A. Szczepanski.
Polskie Archiwum Hydrobiologii, Vol 23, No 2, p 233-248, 1976. 6 Fig, 9 Tab, 20 Ref.

Descriptors: *Marsh plants, *Cattails, *Plant growth, *Soil-water-plant relationships, Wetlands, Biomass, Standing-crop, Fertility, Soils.

The dependence of the production of Phragmites communis and both species of Typha on the content of mud in the soil was distinctly evident under experimental conditions. The increment of the biomass of Phragmites concomitant with the increment of the mud content in the soil is the resultant of an increase in weight of the individual stem and the sprouting of a greater number of new shoots. The increment of the biomass of T. latifolia and T. angustifolia is due chiefly to the increase in weight of the individual plant. The dependence of the production of the plants on the fertility of the soil is strongest in T. latifolia and weakest in Phragmites. An increase of the eutrophic mud content in the soil by 10 percent causes an increment of the plants biomass as follows: in Phragmites--0.28 g dry weight; T. angustifolia--0.35 g; and T. latifolia--0.56 g. (Steiner-Mass)
W80-02330

COMBINED ACTION OF POLYPHENOILS, QUINONES, REDUCERS AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5F.
W80-02331

2J. Erosion and Sedimentation

THE EFFECT OF TILLAGE SYSTEMS ON PESTICIDES IN RUNOFF FROM SMALL WATERSHEDS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, and H. P. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol 22, No 3, p 554-559, May-June 1979, 2 Fig, 4 Tab, 19 Ref. OWRT B-050-IA(3), 14-31-0001-5037.

Descriptors: *Pesticides, *Runoff, *Erosion, Farm practices, Sampling, On-site investigations, Rainfall, Watersheds(Basins), Agricultural watersheds, Insecticides, Herbicides, Sediments, Chemical analysis, Path of pollutants, Tillage practices.

Runoff losses of fonofos (insecticide), alachlor, atrazine, and cyanazine (herbicides) with sediment and water were measured under natural rainfall conditions for 6 small watersheds planted to continuous corn with conventional, till-plant, and ridge-plant tillage systems. Losses were very dependent on the time between pesticide application and the first runoff event. Soil sampling indicated that pesticide half-lives were about 2 weeks (except for atrazine, 1 to 2 months), with pesticides remaining concentrated in the top 5 cm. Not quite 50% of the average fonofos loss was with water, whereas from 80 to 90% of the average herbicide losses were with water. Decreased runoff and erosion for the till-plant and ridge-plant tillage systems relative to conventional resulted in decreased pesticide losses, but pesticide concentrations in sediment and (or) water were sometimes higher for conservation tillage systems. (Sims-ISWS)
W80-02147

PARTICLE SIZE ANALYSIS BY HYDROMETER: A SIMPLIFIED METHOD FOR ROUTINE TEXTURAL ANALYSIS AND A SENSITIVITY TEST OF MEASUREMENT PARAMETERS,
Battelle Pacific Northwest Labs., Richland, WA. Water and Land Resource Dept.
For primary bibliographic entry see Field 2G.
W80-02166

MISSISSIPPI RIVER SHOALING: A DIAGNOSTIC STUDY,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2E.
W80-02186

FLOW FIELD AND SCOURING EFFECTS OF STEADY AND PULSATING JETS IMPINGING ON A MOVABLE BED,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Wasserbau.
H. Kobus, P. Leister, and B. Westrich.
Journal of Hydraulic Research, Vol 17, No 3, p 175-192, 1979. 12 Fig, 17 Ref.

Descriptors: *Scour, *Model studies, *Erosion, *Jets, Stream erosion, Movement, Erosion rates, Hydraulic models, Laboratory tests, Dimensional analysis, Flow, Steady flow, Analysis, Data collections, Analytical techniques, Shape, Unsteady flow, Flow characteristics, *Impinging jets, Movable beds, Scour holes.

The mean and fluctuating components of the flow field of vertical submerged jets impinging on a horizontal rough wall were measured, and the time-development of scour holes due to submerged jets impinging on sand beds of uniform grain size was studied experimentally. Particular attention was paid to the quantification of pulsation effects upon the flow field and the scouring process. The results allowed quantitative assessment of the various parameters upon the scouring process for steady and pulsating jets. In particular, the follow-

ing general conclusions can be derived from the study (1) The scouring process has a logarithmic time dependence. The erosion capacity of a jet depends upon its momentum flux, the nozzle distance from the bed, and the properties of the bed material. (2) Depending on the magnitude of a pressure parameter, different scour forms may e generated. For small values of K sub o (1.2 to 3) one obtains form I, for large values of K sub o (6.5 to 140) the form II, whereas very values of K sub o lead to injection flow. (3) Scour form I shows a shallow profile, in which the wall jet is attached up to the edge of the scour hole. Erosion takes place mainly in the form of bedload transport. (4) Scour form II exhibits a strong deformation in the inner region, where erosion takes place, and straight flanks in the outer region of the scour hole, in which transport in suspension and partial deposition take place. (5) Periodic pulsation of the jet can cause a significant increase of the erosion capacity. This is due to the following factors: (a) more favorable erosion and transport conditions in the deflected jet due to a diminished pressure gradient along the bed; (b) smaller energy loss into the seepage flow on account of the reduction of the pressure gradient, which reduces the seepage flow; and (c) better efficiency of the turbulent transport because of the pronounced radial correlation of the radial velocity components around the circumference. (Humphreys-ISWS)
W80-02188

HYDROLOGIC DATA ON CHANNEL ADJUSTMENTS 1970 TO 1975, ON THE RIO GRANDE DOWNSTREAM FROM COCHITI DAM, NEW MEXICO, BEFORE AND AFTER CLOSURE,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Dewey, R. E. Roybal, and D. E. Funderburg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-301134, Price codes: A23 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-70, May 1979. 531 p, 83 Fig, 3 Tab, 12 Ref.

Descriptors: *Sediment transport, *Channel morphology, *Pre-impoundment, *Post-impoundment, *Distribution patterns, Sediment distribution, Sediment yield, Particle size, Hydrologic data, New Mexico, *Rio Grande(N MEX), Cochiti Dam(N MEX).

Cross-section channel profiles, sediment transport and hydrologic data have been observed and computed for a series of pre-dam and post-dam investigations from 1970 to 1975 at 37 cross sections established along a 59-mile study reach from Cochiti Dam to Isleta Diversion Dam, New Mexico. Cochiti Dam began impounding water in November 1973. Because the dam will trap virtually all of the sediment load originating upstream and water discharge will be controlled, it is expected that equilibrium values of channel width, depth, slope and sediment-transport capability in the existing main stem of the Rio Grande will change. Changes in cross sections with time and space and changes in size distribution of sediments are documented. (Woodard-USGS).
W80-02230

INCEPTION OF SEDIMENT TRANSPORT,
Queen's Univ., Kingston (Ontario), Dept. of Civil Engineering.
M. S. Yalin, and E. Karahan.
Journal of the Hydraulics Division, Amerian Soceity of Civil Engineers, Vol 105, No HY11, Proceedings Paper 14975, p 1433-1443, November 1979. 5 Fig, 1 Tab, 19 Ref, 2 Append.

Descriptors: *Bed load, *Sediment transport, *Alluvial channels, *Boundary processes, Movement, Sedimentation, Laminar flow, Turbulent flow, Laboratory tests, Analytical techniques, Analysis, Boundary layers, Shear stress, Sands, Cohensionless soils, Flow, Shields curve, Critical shear stress.

Sediment transport inception curves corresponding to both laminar and turbulent flows were presented. Using these curves, one can determine the critical bed shear stress (corresponding to the beginning of sediment transport), depending on the properties of the fluid and of the cohesionless bed material. The laminar flow curve has been revealed on the basis of laboratory measurements. The curve corresponding to turbulent flows was established mainly using the available datd of previous researchers. It was found that the laminar flow curve lies in the Shields' plane higher than the turbulent flow curve, and thus it yields larger critical values of the dimensionless bed shear stress. Both curves tend to become indistinguishable from each other when the grain size Reynolds number decreases. i.e., when the influence of viscosity on the turbulent flow at bed increases. For larger values of this number, the turbulent flow curve can be identified with the classical Shields' curve. (Humphreys-ISWS)
W80-02340

CHEMICAL AND SUSPENDED-SEDIMENT CHARACTERISTICS OF RIVERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2A.
W80-02400

2K. Chemical Processes

COMPOSITION OF TRINIDAD RAINFALL,
University of the West Indies, St. Augustine (Trinidad).
R. C. Dalal.
Water Resources Research, Vol 15, No 5, p 1217-1223, October 1979. 3 Fig, 8 Tab, 46 Ref.

Descriptors: *Chemistry of precipitation, *Rainfall, *Rain water, *Chemical analysis, *Statistical analysis, Chemicals, Nutrients, Nitrogen compounds, Magnesium, Calcium, Sodium, Potassium, Chlorine, Sulfur compounds, Sulfur, Sampling, Soils, *Trinidad.

The rainwater collected from daily rainfalls at 6 rainfall stations in Trinidad over a 1-year period was analyzed for NH4(+), NO3(-), urea-N, Mg(2+), Ca(2+), Na(+), K(+), Cl(-), and SO4(2-) concentrations. The concentration of these constituents varied from 0.41 to 1.13, 0.41 to 1.24, 0.15 to 0.50, 0.33 to 0.99, 1.88 to 4.52, 1.92 to 2.57, 1.21 to 3.27, 2.10 to 3.93, and 1.89 to 17.75 mg/l of NH4-N, NO3-N, urea-N, Mg(2+), Ca(2+), Na(+), K(+), Cl(-), and SO4(2-), respectively. Considerable amounts of these constituents were added to the soil through rainfall. Major proportions of NH4(+) and NO3(-) and some proportions of SO4(2-) in rainwater may have been derived from gaseous sources, probably originating from soil. Urea-N seems to have originated as particulate matter from soil organic matter and microbial cell debris. Greater proportions of Ca(2+) and K(+), and smaller proportions of Mg(2+) and SO4(2-) appear to have been derived from terrestrial dust. Sodium, Cl(-), Mg(2+) and partly Ca(2+), K(+), and SO4(2-) were derived from marine sources. Thus, it appears that the sources of various constituents in the Trinidad rainfall are quite varied. (Sims-ISWS)
W80-02179

QUALITY OF SURFACE AND GROUND WATERS, YAKIMA INDIAN RESERVATION, WASHINGTON, 1973-74,
Geological Survey, Tacoma, WA. Water Resources Div.
M. O. Fretwell.
Geological Survey open-file report 77-128, 1979. 177 p, 29 Fig, 2 Plates, 6 Tab, 38 Ref.

Descriptors: *Water quality, *Surface waters, *Groundwater, *Indian reservations, *Washington, Water analysis, Chemical analysis, Irrigation water, Fertilizers, Nitrates, Phosphates, Pesticides, Trace elements, Dissolved solids, Bacteria, Physical properties, *Yakima Indian Reservation(Wash).

This report describes the quality of the surface and ground waters of the Yakima Indian Reservation in south-central Washington, during the period November 1973-October 1974. The average dissolved-solids concentrations ranged from 48 to 116 mg/L (milligrams per liter) in the mountain streams, and from 88 to 372 mg/L in the lowland streams, drains, and a canal. All the mountain streams contain soft water (classified as 0-60 mg/L hardness as CaC03), and the lowland streams, drains, and canal contain soft to very hard water (more than 180 mg/L hardness as CaC03). The water is generally of suitable quality for irrigation, and neither salinity nor sodium hazards are a problem in waters from any of the streams studied. The specific conductance of water from the major aquifers ranged from 20 to 1,540 micromhos. Ground water was most dilute in mineral content in the Klickitat River basin and most concentrated in part of the Satus Creek basin. The ground water in the Satus Creek basin with the most concentrated mineral content also contained the highest percentage composition of sulfate, chloride, and nitrate. For drinking water, the nitrate-nitrogen concentrations exceeded the U.S. Public Health Service's recommended limit of 10 mg/L over an area of several square miles, with a maximum observed concentration of 170 mg/L. (Woodard-USGS).
W80-02245

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

2L. Estuaries

THE ALASKAN OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
For primary bibliographic entry see Field 5C.
W80-02064

PREDICTING LEVEL OF DISSOLVED REACTIVE PHOSPHATE IN THE LAFAYETTE RIVER, VIRGINIA, FROM INFORMATION ON TIDE, WIND, TEMPERATURE, AND SEWAGE DISCHARGE,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W80-02178

SHORT-TERM COVARIABILITY OF CHLOROPHYLL AND TEMPERATURE IN THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Dept. de Biologie.
S. Demers, P. R. Lafleur, L. Legendre, and C. L. Trump.
Journal of the Fisheries Research Board of Canada, Vol 36, No 5, p 568-573, May 1978. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Estuaries, *Water quality, *On-site investigations, *Tidal effects, Water temperature, Chlorophyll, analysis, Analytical techniques, On-site data collections, Phytoplankton, Tidal waters, *St. Lawrence estuary.

Time series of chlorophyll a fluorescence and temperature taken at a depth of 1 m were recorded at 4-min intervals for 136.5 h, at an anchor station located in the Middle Estuary of the St. Lawrence. The sampling program was carried out during the transition from neap tides to spring tides. Power spectral analysis was applied to the series, and variance spectral estimated. Coherency spectra between fluorescence and temperature were also computed. Results indicated that chlorophyll distribution was controlled by physical processes during neap tides. Conversely, lesser amounts of chlorophyll a per cell and lesser production rates were noted during spring tides. A flattening of the chlorophyll spectrum was observed for this part of the study. This result was interpreted in terms of the poor physiological state of the phytoplankton population that was sampled during the second part of the study, a different density structure

being present due to the change in tidal energy. (Humphreys-ISWS)
W80-02184

SEA SURFACE TEMPERATURES NEAR A BAY INLET ZONE,
Brookhaven National Lab., Upton, NY. Atmospheric Sciences Div.
M. D. Powell, and S. Sethuraman.
Journal of Geophysical Research, Vol 84, No C11, p 7012-7016, November 20, 1979. 7 Fig, 1 Tab, 11 Ref. DOE EY-76-C-02-0016.

Descriptors: *Water temperature, *Bays, *Inlets(Waterways), *Coasts, *New York, Remote sensing, Aircraft, Surveys, Temperature, Winds, Flow, Tides, Tidal waters, Weather, Estuaries, Sea surface temperatures.

Results of an investigation of the radiometric sea surface temperature distribution near Shinnecock Inlet off Long Island were presented. The data were gathered by 10 individual aircraft flights during the summer of 1975. Inflow into or outflow from the inlet could be easily identified with sea surface temperature measurements. (Sims-ISWS).
W80-02220

MITIGATION: A CONCEPT FOR WETLAND RESTORATION,
Oregon State Dept. of Land Conservation and Development, Salem.
For primary bibliographic entry see Field 6E.
W80-02288

MARYLAND USES NALED AGAINST SALT MARSH MOSQUITOES.
For primary bibliographic entry see Field 2I.
W80-02322

HALOPHYTES: ADAPTIVE MECHANISMS,
For primary bibliographic entry see Field 2I.
W80-02324

HALOPHYTES, ENERGETICS AND ECOSYSTEMS,
Georgia Univ., Athens. Inst. of Ecology.
E. P. Odum.
In: Ecology of Halophytes, Reimold, R. J. and Queen, W. H. (eds.), Academic Press, Inc., New York, p 599-602, 1974. 3 Ref.

Descriptors: *Salt marshes, *Energy budget, *Ecosystems, Wetlands, Marshes, Marsh plants, Energy transfer, Productivity, Succession, Georgia.

Halophyte communities such as salt marshes in tidal estuaries have a productivity in the range of 10,000 to 40,000 kcal/sq m/year, and are clearly subsidized by the energy of the tides, waves, and other water flows. The high productivity of such stands is in sharp contrast to halophyte communities growing in or around a salt lake where the same level of sun energy might be received, but where there is no mechanical energy subsidy to overcome the stress of the salty substrate. The salt marsh estuary functions as a detritus ecosystem as does a young forest or a freshwater marsh, but unlike a stable water level marsh, or an early successional terrestrial community, litter does not accumulate in the estuary because tidal action hastens removal and decomposition of net production as fast as it is produced. Accordingly, the Spartina salt marsh in Georgia is viewed not as a successional stage leading to another type of vegetation but as a pulse-stabilized climax where change over long periods of time is more a function of geologic or allogenic, such as a changing sea level, than autogenic processes within the ecosystem. (Steiner-Mass)
W80-02329

WAVE DIFFRACTION BY ABSORBING WEDGE,
Math-Tech Inst., Charlottenlund (Denmark).
J. Larsen.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 15000, p 439-449, November 1979. 4 Fig, 14 Ref, 4 Append.

Descriptors: *Waves(Water), *Breakwaters, *Model studies, Mathematical models, Refraction(Water waves), Absorption, Winds, Hydraulics, Coasts, Harbors, Diffraction, Wave diffraction, Impedance, Absorbing wedges.

Diffraction of waves by a vertical absorbing wedge was examined. A useful approximate solution, which is in contrast to previous results and is applicable when the two wedge faces have different reflection properties, was presented. The approximate solution was compared with the asymptotic representation of the exact solution to the impedance wedge diffraction problem revealing good agreement. The approximate solution has been used in a harbor theory for wind-generated waves. (Sims-ISWS)
W80-02335

INLET STABILITY SOLUTIONS FOR TRIBUTARY INFLOW,
Army Engineer District, Mobile, AL.
F. F. Escoffier, and T. L. Walton, Jr.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14964, p 341-355, November 1979. 7 Fig, 2 Tab, 8 Ref, 4 Append.

Descriptors: *Inlets(Waterways), *Currents(Water), *Estuaries, *Florida, Bays, Oceans, Tributaries, Coasts, Tides, Tidal waters, Circulation, Stability, Water circulation, Velocity, Water levels, Model studies, Mathematical models, Coastal engineering.

Formulas in use relating to the flow of water through tidal inlets do not take into account the joint effects of inertia and tributary inflow that play a significant role in determining the characteristics of many inlets. In a proposed analytical model, these two factors are considered where the tributary inflow to the bay causes ebb flow through the inlet to exceed flood flow. The solution method applies to the same type inlets previously studies, i.e., inlets that have a bay in which the water rises and falls uniformly over the entire bay area. An additional assumption is that the discharge into and from the inlet is governed by a head loss that is quadratic in velocity. (Sims-ISWS)
W80-02339

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE POTENTIAL OF ECONOMIC DESALINIZATION FOR SMALL SYSTEMS,
URS Corp., San Mateo, CA.
For primary bibliographic entry see Field 6B.
W80-02001

DEVICE FOR PRODUCING DEEPLY DESALTED WATER,
N. N. Azarov, G. A. Zelensky, and I. V. Borisovsky.
U.S. Patent No 4,165,273, 5 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 686, August 21, 1979.

Descriptors: *Parents, *Desalination, *Water purification, *Separation techniques, Membranes, Electrodes, Ion exchange, Resins, Desalination apparatus.

A device is proposed for producing deeply desalted water. The device comprises a dielectric housing in which cooled electrodes and ion-exchange membranes are located. The electrodes are rods located parallel with respect to one another in vertexes of at least one regular hexagon with alternating polarity. Each membrane is made in the form of a tube and located concentrically to the corresponding electrode, the polarity of the membrane and of the electrode being the same. The device comprises desalinization chambers for sorption of the salt ions from the water being treated, the chambers being filled with ion-exchange resins. The desalination chambers are formed by membranes, located between them and connected with each other. The device also contains brine chambers for removing the salt ions with the water being passed through the chambers. Each brine chamber is defined by one of the corresponding membranes. The proposed device is small in size, highly efficient, reliable and safe in operation. (Sinha-OEIS)
W80-02066

DESALINATION METHOD WITH MERCURY REFRIGERANT,
Fabrication de Maquinas, S. A. Monterrey (Mexico).
J. K. Martin.
U.S. Patent No 4,164,854, 4 p, 2 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 551-552, August 21, 1979.

Descriptors: *Patents, *Desalination, *Water purification, *Separation techniques, Saline water, Freezing, Crystal growth, Heat exchange, Mercury, Desalination apparatus.

A salt water purification apparatus and process utilizes a vertically arranged elongated tank in which salt water is first frozen into a solid block and then melted to provide pure water. The freezing is accomplished by injecting into a column of salt water within the tank, a finely atomized spray of precooled mercury to absorb heat from the water and to initiate the formation of ice crystals in the ice column. The mercury is continuously recirculated through a cooling means and the ice crystals accumulate in the upper portion of the tank due to their inherent buoyancy when they form a solid block of ice. A heat exchanger positioned in the upper portion of the tank thaws the upper portion of the ice block by indirect heat exchange with the incoming salt water feed. The block is moved upwardly in the tank due to hydraulic pressure created below the block by the salt water feed. Fresh water can therefore, be continuously or intermittently withdrawn from the upper portion of the tank and concentrated brine and precipitated salts withdrawn from the lower portion of the tank. (Sinha-OEIS)
W80-02080

FUNDAMENTAL STUDIES OF DESALINATION BY FREEZING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
K. A. Smith, and A. F. Sarofim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124316, Price codes: A04 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, January 1979. 72 p, 34 Fig, 8 Tab, 10 Ref. OWRT (No 3268)(1), 14-20-3268.

Descriptors: *Desalination, *Freezing, *Crystal growth, Crystallization, *Nucleation, Supercooling, *Heat transfer, *Mass transfer, Diffusion, Permeability.

Studies on a pilot-scale crystallizer were used to determine the subcooling of the brine solution, the particle size distribution and the permeability of the ice product in a 6% by weight brine solution for various ice preduction rates, agitation powers, and ice concentration. These data were used to generate ice crystal growth rates and nucleation rates to compare with generalized correlations developed for ice growth and nucleation. By application of population balance mathematics to a well-stirred continuous crystallizer, a quantitative relationship between ice partice size and ice production rate was developed. The growth kinetic parameters needed for application of the resulting relations were determined from a systematic study of the mass transfer to discs, spheres, and cylinders suspended in a turbulent agitated fluid. The results could be represented by a single correlation be-

tween the Sherwood number, the Schmidt number, and the Kolmogoroff power number, for a range of impeller designs and types, vessel aspect ratios, and impeller-to-vessel dimensions. Correlations for ice nucleation kinetics were determined from batch crystallizer studies for a wide range of salt concentration, solution subcooling, and agitation power. (Sarofim-Mit)
W80-02155

DEVELOPMENT OF A COMPOSITE REVERSE OSMOSIS MEMBRANE FOR SINGLE PASS SEAWATER DESALINATION,
Envirogenics Systems Co., El Monte, CA.
A. F. Graefe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124 852, Price codes: A03 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, No 1223-15, February 1979. 35 p, 3 Ref. OWRT (No 7541)(1), 14-34-0001-7541.

Descriptors: *Reverse osmosis, *Membrane, *Composite, *Seawater, *Desalination, *Furfuryl alcohol, *Sulfonated furfuryl alcohol, *Sulfonated phenol-aldehyde, *Sulfonated polyphenylene oxide, Polysulfone, Spiral element, Non-cellulosic.

The objective was to develop an improved reverse-osmosis composite non-cellulosic membrane for the single pass desalination of seawater, and to demonstrate its performance in the form of four inch diameter spiral elements. Three membranes were investigated. One membrane consisted of an active barrier layer of polymerized and sulfonated furfuryl alcohol deposited on the surface of a cloth-backed polysulfone microporous support (SPFA membrane). This membrane exhibited outstanding initial reverse-osmosis properties (water fluxes up to 23 gfd at 99.6% salt rejection with simulated seawater at 800 psi), but was inherently unstable. The seat of the instability is believed to lie in the hydrolytic cleavage, with attendant depolymerization, of sulfate ester groups present in the barrier layer. Another membrane consisted of a sulfonated, phenol-aldehyde resin on the same polysulfone support (SPAR). This membrane was also inherently unstable for the reason noted above. The third membrane, which consisted of a sulfonated polyphenylene oxide on the same polysulfone support (SPPO), was found to be unsuitable for the single pass desalination of seawater. It was concluded from the overall experimental data that the fabrication of composite membranes at elevated temperatures in the presence of sulfuric acid is probably attended by complex side reactions, one or more of which could easily lead to membrane instability.
W80-02295

DEVELOPMENT OF LOW PRESSURE BRACKISH WATER REVERSE OSMOSIS MEMBRANES,
Envirogenics Systems Co., El Monte, CA.
A. F. Graefe, and W. J. Schell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126204, Price codes: A03 in paper copy, A03 in microfiche. Final Report to Office of Water Research and Technology No 1093-25, May 1979. 37 p, 3 Fig, 5 Ref. OWRT (No 7510)(1), 14-34-0001-7510.

Descriptors: *Reverse osmosis, *Membrane, *Composite, *Brackish water, *Desalination, *Furfuryl alcohol, *Sulfonated furfuryl alcohol, *Sulfonated polysulfone, Polysulfone, Spiral element, Non-cellulosic, Yuma feedwater.

The objective was to develop chemically stable non-cellulosic desalination membranes with reverse osmosis properties at pressures of 250 psi or less that are equivalent to those of currently available cellulosic membranes operating at 400 psi. It was also desired that the new membranes exhibit improved chemical stability over cellulosic membranes. Several membranes were investigated. One membrane consisted of a thin layer of sulfonated polyfurfuryl alcohol on a microporous polysulfone as a support (SPFA). This membrane exhibited water flux values up to 50 gfd at 98% salt rejection when tested at 250 psi with 0.5% sodium chloride. However, subsequent long term testing of the membrane in element form at 100 to 300 psi showed that it was unstable to simulated Yuma feedwater. Another membrane of interest was asymmetric, and was fabricated from a sulfonated polysulfone (SPS). It was resistant to biodegradation, to high and low pH levels, to elevated temperatures, and to at least 50 ppm of free chlorine. This membrane exhibited excellent stability after an initial deswelling period when tested with simulated Yuma feedwater at 100 to 300 psi, but its reverse osmosis properties were not superior to those of cellulose acetate. Other membranes investigated either exhibited low water flux values or low salt rejection values when tested under brackish water conditions.
W80-02296

3B. Water Yield Improvement

RUNOFF FARMING FOR JOJOBA,
Science and Eduction Administration, Phoenix, AZ. Water Conservation Lab.
D. H. Fink, and W. L. Ehrler.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ., Lubbock, p 212-224, July 1979, 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Water requirements, *Jojoba, *Growth rates, *Water harvesting, *Water yield improvement, Water conservation, Rainfall-runoff relationships, Microenvironment, Catchments, Runoff farming, Experimental farms.

The water requirement of Jojoba (Simmondsia chinensis), a potentially important wax-producing agronomic crop in arid regions, is determined and evaluated here in terms of the prospects of utilizing runoff farming to supply the needed water. Thirty of the most stressed female plants within a one ha fenced marginal stand of Jojoba in the Usery Mountains of the Tonto National Forest near Mesa, Arizona, were selected and randomly divided into 3 runoff-farming treatments of ten plants each. Undisturbed controls, cleared, smoothed, and rolled individual 20m2 microcatchments that directed runoff to a 4m2 runon areas were constructed for each plant. Results indicated that while the minimum water requirement for plant survival in the Phoenix area was 200mm of precipitation, Jojoba seemed to have sigmoidal response to available water, exhibiting esentially no increased growth from this minimum to threshold of 400-500 mm and then accelerated growth beyong this amount. Runoff farming successfully supplied the estimated 900-1300mm a month water requirement for Jojoba based upon a 4 m2 growing area. It is concluded that while more related research is needed, runoff farming should be easily adaptable to Jojoba plantation conditions. (Tickes-Arizona)
W80-02196

WATER YIELD INCREASES THROUGH SURFACE DUSTING OF A PERMANENT ICEFIELD,
White River National Forest, Glenwood Springs, CO.
For primary bibliographic entry see Field 2C.
W80-02358

3C. Use Of Water Of Impaired Quality

MUNICIPAL RECYCLING OF WASTEWATER,
Denver Research Inst., CO.
For primary bibliographic entry see Field 5D.
W80-02044

WASTEWATER APPLICATIONS TO IRON-ORE OVERBURDEN MATERIAL IN NORTHEASTERN MINNESOTA: PROSPECTS FOR RENOVATION AND RECLAMATION,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
For primary bibliographic entry see Field 5E.
W80-02052

THE EFFECT OF SEWAGE SPRAY IRRIGATION ON DISEASE VECTORS - JULY 1975 - DECEMBER 1978,
Michigan State Univ., East Lansing, Dept. of Entomology.
M. Zaim, H. D. Newson, J. S. Rogers, and E. L. Payne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-123656, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, December, 1979. 20 p, 3 Fig, 1 Tab, 23 Ref. OWRT B-040-MICH(1), 14-31-0001-6040.

Descriptors: *Sewage, *Wastewater spray irrigation, *Mosquitoes, Vectors, Dog heartworm, California encephalitis, St. Louis encephalitis, *Water quality project site, *Michigan, Spray irrigation planning and operations.

Four consecutive years of municipal sewage disposal by spray irrigation produced marked changes in the populations and species composition of the mosquitoes present in an experimental water quality management project in Michigan (Michigan State University). These changes are described and their relevance to the wide-spread use of similar sewage disposal systems are discussed. The impact of these changes on the transmission potential of enzootic mosquito-borne diseases in the vicinity of the project site also is discussed. The study results support the contention that planners and managers of similar sewage spray irrigation projects should be aware of the biological consequences of their operations and incorporate appropriate safeguards to minimize or prevent the potential for insect pests and disease transmission problems that are inherent in the operation of these types of sewage disposal systems. (Newson-Michigan)
W80-02156

SALT-TOLERANT CROPS AND SALINE WATER: RESOURCES FOR ARID LANDS,
California Univ., Davis. Dept. of Land Air and Water Resources.
D. B. Kelly, J. D. Norlyn, and E. Epstein.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 326-334, July 1979. 24 Ref.

Descriptors: *Salt tolerance, *Plant physiology, *Sea water, *Saline water, *Plant breeding, *Crop response, Feasibility studies, Variability, Soil-water-plant relationships, Photosynthesis, Transpiration, Adsorption, Arid lands.

Reported are the results of a feasibility study conducted on the selection and breeding of salt-tolerant crops for agriculture under extreme conditions of salinity: irrigation with seawater in the coastal sands of Northern California. Evidence is presented that there exists within certain crop species the genetic variability that when properly identified and expressed can allow strains of that crop to tolerate highly saline media. Data from three years of fields trials using seawater irrigation shows that crops specifically selected for salt tolerance provide appreciable yields under this very saline condition. Perhaps the most important by-product of the present study was the generation of plants with contrasting salt tolerance. The physiology of each line so far investigated can be compared with its sensitivie or tolerant counterpart. Ion uptake and transport, photosynthetic and transpirational responses, and the many structural differences found in sensitive and salt-tolerant lines are currently being investigated and promise to be invaluable in the search for explanations of how plants tolerate salinity stress. (Tickes-Arizona)
W80-02197

EFFECT OF USING SEWAGE EFFLUENT ON CALCAREOUS SOILS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.

B. D. McCaslin, and V. Lee-Rodriquez.
In: Arid Land Plant Resources, Proceedings of the International Arid Land Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech Univ. Lubbock, p 598-614, July 1979, 4 Fig, 5 Tab, 32 Ref.

Descriptors: *Water reuse, *Calcareous soils, *Water pollution effects, *Soil-water-plant relationships, *Rates of application, *Cycling nutrients, Sewage treatment, Sewage sludge, Water pollution sources, Effluents, Heavy metals, Crop response, Environmental effects, Irrigation water, New Mexico.

Although the beneficial effects of treated municipal wastewater or sludges in arid regions are well known, it is important to restrict application rates to levels that will prevent both the build up of toxic materials in the environment and the pollution of groundwater supplies. The objectives of the present study were to examine the effects of long term applications of secondary sewage effluent on (1) the iron and heavy metal concentrations in a calcareous soil, and (2) on plants grown in this soil. Fields that had been irrigated for 40 years with secondary sewage effluent from the city of Clovis, New Mexico, were compared by physical and chemical analysis to adjacent fields which had never irrigated with effluent. Plant tissue analysis indicated normal concentrations of the micronutrients Fe, Zn, Mn, and Cu and no detectable Cd, Ni, Cr, and Pb after 40 years of effluent application on calcareous soils. Effluent data indicated no salt or sodium hazard and no Cd, Cr, Ni, or Pb accumulation. In general it was concluded that sewage effluent is a potential source of irrigation water and plant nutrients on southwestern agricultural calcareous soils. (Tickes-Arizona)
W80-02200

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3E.
W80-02354

3D. Conservation In Domestic and Municipal Use

DEVELOPING A CONSERVATION PROGRAM TAILORED TO AREA NEEDS,
Mathematical Sciences Northwest, Bellevue, WA.
G. R. Minton, R. William, and T. Murdock.
American Water Works Association Journal, Vol 71, No 9, p 486-496, September 1979. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Water conservation, *Water demand, *Municipal water, *Water consumption, *Consumptive use, *Water supply, Water utilization, Anchorage(AK), Wastewater reuse, Metering, Building codes, Water management(applied), Water policy.

This article examines alternative water use measurement and water conservation options for the city of Anchorage (AK), one of the fastest growing urban areas of the United States. Population is expected to double by 2000, and present groundwater sources are inadequate. Water conservation could mitigate the area's water supply problem for the next decade by providing time to develop new sources. The U.S. Army Corps of Engineers and the municipality of Anchorage have jointly studied the water resources for the area. Three large purveyors serve the area in addition to 13 small purveyors and individual wells. Water use in the area increases in winter as consumers run water continuously to prevent their pipes from freezing; water for the purpose averaged 12.5 ML/day (3.3 mgd) from the Anchorage Water Utility (AWU), the largest purveyor. Estimated 1977 water use (29.1 mgd) exceeded 1976 production (28.7 mgd). Water conservation methods that can be used to achieve residential conservation include increased water metering, public education, pricing systems, devices and appliances, and establishment of stricter building codes; industrial and commercial conservation can be achieved through rate structures for sewer services and water costs. Additional conservation can be achieved through better management and maintenance of the existing city sewer system. It is recommended that freeze-prone pipes be buried deeper. Three possible conservation program options--low intensity, moderate and high intensity--are suggested and costs and savings for each presented. Savings would range from $219,000 and 5.4 mgd to $5.71 million and 16.8 mgd by the year 2000. (Arnold-NC)
W80-02045

URBAN DROUGHT IN THE SAN FRANCISCO BAY AREA: A STUDY OF INSTITUTIONAL AND SOCIAL RESILIENCY,
Teknekron, Inc., Berkeley, CA.
For primary bibliographic entry see Field 6D.
W80-02046

LEAK DETECTION: MODERN METHODS, COST, AND BENEFITS,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6B.
W80-02136

A DO-IT-YOURSELF LEAK SURVEY BENEFIT-COST STUDY,
Los Angeles City Dept. of Water and Power, CA.
For primary bibliographic entry see Field 6B.
W80-02137

3E. Conservation In Industry

URBAN DROUGHT IN THE SAN FRANCISCO BAY AREA: A STUDY OF INSTITUTIONAL AND SOCIAL RESILIENCY,
Teknekron, Inc., Berkeley, CA.
For primary bibliographic entry see Field 6D.
W80-02046

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, G. Sinai, and L. H. Stolzy.
Water Resources Bulletin, Vol 15, No 5, p 1444-1458, October 1979. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Cooling water, *Arid lands, *Powerplants, Water requirements, Water resources, Water demand, Legislation, Evaporation, Water users, Consumptive use, Environment, Environmental effects, Industry, Industrial wastes, Water quality, Irrigation, Blowdown water, Evaporation ponds.

Electric generation facility water requirement will increase substantially in the future in the Western United States because new power plants are to be constructed at inland sites rather than on the coast. At the inland locations, power plants will have to compete with agriculture and public users for freshwater supplies, and will be constrained by environmental legislation to dispose of cooling waste water in lined evaporation ponds. The various options for power plant cooling were analyzed in respect to cost, water consumption, and environmental hazard, and also in respect to their compatibility with existing state and federal regulations. Several proposals for balancing the water requirements of various users in water-scarce areas were reviewed and criticized. (Sims-ISWS)
W80-02354

3F. Conservation In Agriculture

SPRINKLER HEAD WITH IMPROVED INTEGRAL IMPACT ARM AND ANTI-BACKSPLASH DRIVE SPOON,
Nelson (L. R.) Corp., Peoria, IL. (Assignee).
K. J. Bruninga.
U.S. Patent No 4,164,324, 10 p, 8 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 369, August 14, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, *Sprinkler irrigation, Irrigation efficiency, Irrigation practices.

A part-circle step-by-step rotary sprinkler head has an improved anti-backsplash drive spoon integrally formed as a part of the impact arm. Its construction is related to the longitudinal axis of the outlet when the arm is in its impact limiting position which comprises upper and lower walls in a position to receive the stream between them. (Sinha - OEIS)
W80-02139

BRACING ATTACHMENT FOR WHEELED SPRINKLER SYSTEM,
M. Ellison.
U.S. Patent No 4,164,323, 4 p, 3 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 368-369, August 14, 1979.

Descriptors: *Patents, *Irrigation systems, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance.

The invention relates to bracing devices for selectively immobilizing certain of the wheels in a wheeled sprinkler system used to irrigate agricultural crops. Attached to the selected wheels are braces comprising two pivoted arms which can be swung between a first, inoperative position within the compass of the wheel and a second, operative position in which the two arms located 180 degrees apart extend outwardly and downwardly at approximately 45 degrees from the wheel into engagement with the ground. A foot plate carrying spikes on the ends of the arms enhances the anchoring effort. (Sinha - OEIS)
W80-02140

DEVICE FOR SOIL IRRIGATION,
Rhone-Poulenc-Textile, Lyons, (France). (Assignee).
Y. Gaudard, H. Guillemaud, and J. Perfetti.
U.S. Patent No 4,162,863, 6 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 984, No 5, p 1161, July 31, 1979.

Descriptors: *Patents, *Irrigation, *Subsurface irrigation, *Application equipment, Absorption, Moisture, Soil-water-plant relationships, Irrigation efficiency, Hydrophilic textile.

An irrigating device formed from an absorbent product, such as a polymeric pulp or hydrophilic textile contained within a filtering envelope such as a woven, knitted or non-woven fabric is placed in the ground in communication with a source of water which may be above or below ground. The irrigation device provides for a uniform rate of irrigation of the soil in which it is placed, required less water than conventional irrigation devices providing the same overall coverage, and is not subject to clogging or blockage, as with conventional irrigation devices. In one embodiment for preparing the irrigation device, the absorbent product is in the form of a tow of hydrophilic continuous filament and the textile filter envelope is produced in a continuous in-line operation in conjunction with the production of the tow. The irrigation device can be applied to the irrigation of soils to facilitate the growth of plants, trees, crops and the germination of seeds. (Sinha - OEIS)
W80-02149

SAHARA FARMING IRRIGATION PROBLEMS AND REMEDY RECOMMENDATIONS,
H. F. Mirreh.
In: Advances in Desert and Arid Land Technology and Development, Vol 1, ed. by Adli Bishay and Wm. G. MCGinnies, Harwood Academic Pub. p 231-247, 1979, 3 Fig, 10 Tab, 14 Ref.

Descriptors: *Irrigation practices, *Soil physical properties, *Crop response, *Agroclimatology, Irrigation engineering, Irrigation programs, Soil-water-plant relationships, Irrigation systems, Soil Moisture, Evapotranspiration, Arid lands, Sahara, Root zone.

Reviewed are various crop watering problems in the Sahara where severe weather conditions combine with low water supplying soils and limited crop rooting patterns to cause severe water stress and considerable irrigation problems during periods of high evapotranspiration. Techniques both to improve the efficiency of applied fertilizer and irrigation water and to upgrade the water storage capacity of Sahara soils that have been successful in other arid countries are discussed with the conclusion that currently practiced techniques require modification to make them adaptable to Saharan conditions. (Tickes-Arizona)
W80-02209

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD PLAIN INFORMATION: KUSKOKWIM RIVER, MCGRATH, ALASKA.
Army Engineer District, Anchorage, AK.
For primary bibliographic entry see Field 2E.
W80-02014

FLOOD PLAIN INFORMATION: DRY CREEK, BOULDER COUNTY-WELD COUNTY, COLORADO.
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W80-02015

FLOOD PLAIN INFORMATION: SHREVEPORT, LOUISIANA, NO. 2, BRUSH BAYOU AND TRIBUTARIES.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W80-02016

FLOOD PLAIN INFORMATION: PEARL RIVER, BOGUE LUSA AND COBURN CREEKS VICINITY OF BOGALUSA, LA.
Army Engineer District, Mobile, AL.
For primary bibliographic entry see Field 2E.
W80-02017

FLOOD PLAIN INFORMATION: UPPER WHITE ROCK CREEK, PLANO, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02019

FLOOD PLAIN INFORMATION: MARINE CREEK, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W80-02020

FLOOD PLAIN INFORMATION: PARTS I AND II; TAOS COUNTY - NEW MEXICO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W80-02021

FLOOD HAZARD ANALYSES: NORTH FORK - NEW RIVER, ASHE COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
For primary bibliographic entry see Field 2E.
W80-02030

FLOOD HAZARD ANALYSES: ARARAT RIVER, SURRY COUNTY, NORTH CAROLINA.
Soil Conservation Service, Raleigh, NC.
For primary bibliographic entry see Field 2E.
W80-02031

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX IX-FLOOD CONTROL.
California Region Framework Study Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 196, Price codes: A21 in paper copy, A01 in microfiche. Prepared for Pacific Southwest Inter-Agency Committee, Water Resources Council, June 1971. 478 p, 23 Fig, 15 Tab, 6 Maps, 50 Photographs, 190 Ref.

Descriptors: *Flood control, *Water resources development, *California, *Flood protection, *Flood data, *Multiple purpose projects, *Flood plain management, *Control structures, *Non-structural alternatives, *Oregon, Runoff, Planning, Flooding, Water management, Weather modification, River basins.

This report is part of a study undertaken under the guidance of the U.S. Water Resources Council to evaluate alternative water and related land resources for the California Region, an area consisting of all of California and 7% of Oregon. This appendix presents an evaluation and general appraisal of present and future flood problems of the Region. An overall summary of flood control measures precedes data summaries of the flood control situation in each of the regions 11 subregions. The flood history of the region indicates periodic flooding, particularly during the wetter, winter months. Findings indicate that current flood planning programs and warning systems are well developed, but damages from flooding continue to increase. Considerable population growth between 1965 and 2020 is projected and recurring floods will cause increased damage and loss of life. Future flood control measures for the region should include increasingly comprehensive flood forecasting programs (particularly emphasizing satellite information relay capability), additional studies to evaluate the expanding role of flood plain regulation, increased use of flood control storage, use of levees and channels, and the evaluation of the effects of structural measures on the environment, more detailed studies to integrate all control measures within a single program framework, additional runoff research, and expansion of current flood forecasting and weather modification studies. (Arnold-NC)
W80-02034

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE CLEVELAND-AKRON, THREE RIVERS WATERSHED AREA: TECHNICAL APPENDIX-PHASE I: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02042

REAL-TIME HOURLY RESERVOIR OPERATION,
California Univ., Los Angeles. Dept. of Engineering Systems.
W. W-G. Yeh, L. Becker, and W. S. Chu.
Journal of the Water Resources Planning and Management Division, ASCE, Vol 105, No WR2, p 187-203, September 1979, 4 Fig, 4 Tab, 64 Ref. OWRT C-7099 No 6209 (4), 14-34-0001-6209.

Descriptors: *Real-time reservoir operation, *Hydroelectric power, *Optimization, *Linear programming, *Dynamic programming, Systems analysis, Operations research, Reservoir operation, *California Central Valley Project, *Real-time decision making.

An hourly optimization model is developed for online use in the operation of the Central Valley Project (CVP) in California. The hourly model is supplemental to monthly and daily optimization models previously developed for the CVP, and maximizes a weighted summation of generated power over a 24-hr period subject to specified plant releases obtained from a daily model, a desired hourly power schedule, and apropriate system and equipment constraints. The procedure has been developed in two phases. Phase I involves a determination of a good feasible policy (a set of releases) throgh an iterated linear programming and adjust process. Phase II uses this feasible policy as a starting policy in an incremental dynamic programming, successive approximations process to derive an optimal policy. CVP operational records of some typical days are compared with the model outputs for these days, and significant improvements are observed.
W80-02160

WATER QUALITY IN THE PROPOSED PROSPERITY RESERVOIR AREA, CENTER CREEK BASIN, MISSOURI,
Geological Survey, Rolla, Mo. Water Resources Div.
J. H. Barks, and W. R. Berkas.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A072 720, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-22, February 1979. 26 p, 1 Fig, 6 Tab, 15 Ref.

Descriptors: *Baseline studies, *Water quality, *Streams, *Pre-impoundment, *Water analysis, Chemical analysis, Water types, Trace elements, Nutrients, Coliforms, Pesticides, Bacteria, Organic wastes, Evaluation, Reservoir sites, Center Creek basin(Mo).

Water in Center Creek basin, Mo., upstream from the proposed Prosperity Reservoir damsite is a calcium bicarbonate type that is moderately mineralized, hard, and slightly alkaline. Ammonia and organic nitrogen, phosphorus, total organic carbon, chemical oxygen demand, and bacteria increased considerably during storm runoff, probably due to livestock wastes. Nitrogen and phosphorus concentrations are probably high enough to cause the proposed lake to be eutrophic. Minor-element concentrations were at or near normal levels in Center and Jones Creeks. The only pesticides detected were 0.01 micrograms per liter of 2, 4, 5-T in one base-flow sample and 0.02 to 0.04 micrograms per liter of 2, 4, 5-T and 2, 4-D in all storm-runoff samples. Fecal coliform and fecal streptococcus densities ranged from 2 to 650 and 2 to 550 colonies per 100 milliliters, respectively, during base flow, but were 17,000 to 45,000 and 27,000 to 70,000 colonies per 100 milliliters, respectively, during storm runoff. Water in Center Creek about 2.5 miles downstream from the proposed damsite is similar in quality to that upstream from the damsite except for higher concentrations of sodium, sulfate, chloride, fluoride, nitrogen, and phosphorus. These higher concentrations are caused by fertilizer industry wastes that enter Center Creek about 1.0 mile downstream from the proposed damsite. (Woodard-USGS).
W80-02234

EFFECTS OF SEEPAGE FROM FLY-ASH SETTLING PONDS AND CONSTRUCTION DEWATERING ON GROUND-WATER LEVELS IN THE COWLES UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
W. Meyer, and P. Tucci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-300843, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-138, January 1979. 95 p, 38 Fig, 4 Tab, 10 Ref.

Descriptors: *Settling basins, *Ponds, *Fly ash, *Seepage, *Water levels, Groundwater, Groundwater movement, Aquifers, Construction, Dewatering, Model studies, Hydrogeology, Surface-groundwater relationships, Indiana, *Indiana Dunes National Lakeshore, Fly-ash settling ponds.

Part of the Indiana Dunes National Lakeshore shares a common boundary with the Northern Indiana Public Service Company (NIPSCO). This area is underlain by unconsolidated deposits approximately 180 feet thick. NIPSCO accumulates fly ash from the burning of coal in electric-power generating units in settling ponds. Seepage from the ponds has raised ground-water levels above natural levels approximately 15 feet under the

ponds and more than 10 feet within the Lakeshore. NIPSCO is presently (1977) constructing a nuclear powerplant, and construction activities include pumping ground water to dewater the construction site. The company has installed a slurry wall around the site to prevent lowering of groundwater levels within the Lakeshore. Plans call for continuous pumping through at least December 1979. A multilayered digital flow model was constructed to simulate the ground-water system. The model was used to demonstrate the effects of seepage from the fly-ash ponds on ground-water levels. Also, the model indicated a decline of 3 feet or less in the upper sand unit and 5 feet or less in the lower sand unit within the Lakeshore. (Woodard-USGS).
W80-02239

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

THE HAZARDS OF WETLANDS USE,
Colorado Univ., Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6E.
W80-02254

MINIMIZATION OF CONSTRUCTION IMPACTS ON WETLANDS: DREDGE AND FILL, DAMS, DIKES, AND CHANNELIZATION,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6B.
W80-02258

WETLAND REHABILITATION,
Environmental Concern, Inc., St. Michaels, MD.
E. W. Garbisch Jr.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 217-219, 1978 15 Ref.

Descriptors: *Marsh, *Rehabilitation, *Technology, *Feasibility, Wetlands, Ecology, Water resources development, Freshwater marshes, Aquatic plants, Value, Costs, Environmental effects, Salt marshes, Economics, Preservation.

Despite the progress that has been made, marsh rehabilitation must be considered a young and developing technology that has been applied mostly to salt water and brackish water areas. Although general guidelines may be helpful, most sites have such unique characteristics that the ultimate design and implementation of the rehabilitation program must be site specific. The costs of marsh rehabilitation depend upon the plant materials used, the planting density, the techniques of planting, the size of the project, whether fertilizer is necessary, whether the project is maintained after planting, the distance of the site from the contractor, and the accessibility of the site. The commonly recognized important marsh functions maximize operationally in an established marsh within 1 to 3 years, depending on the establishment design. There is no indication that these functions are superior in natural as opposed to established marshes. (See also W80-02253) (Howard-Mass)
W80-02287

4B. Groundwater Management

GROUND-WATER RESOURCE MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Inst. of Agriculture and Natural Resources.
C. A. P. Fricke, and D. T. Pederson.
Ground Water, Vol 17, No 6, p 544-549, November-December 1979. 3 Fig, 4 Ref.

Descriptors: *Groundwater, *Water management(Applied), *Groundwater resources, *Nebraska, Water law, Irrigation, Water levels, Pumping, Water supply, Water demand, Water resources, Semiarid climates.

In order to regulate the use of groundwater, State agencies and local government, together with local public participation, have developed a management policy which is now being implemented in Nebraska. A water resource agency, a geological survey, and a local, multi-county governmental unit were combined with several other governmental units to investigate water problems and to guide a variety of vested interests toward a common goal of efficient water resource management. The key government document delegating the authority and guiding the agencies is the Nebraska Ground Water Management Act of 1975. This Act specifies a procedure whereby local residents concerned about misuse and depletion of their groundwater supplies can request that official hearings be held, water supply evaluations be made, and consideration be given by the Nebraska Department of Water Resources to establish what is called a 'control area.' Designation of a control area allows development and enforcement of methods to deal with the water resource problem within that area. The management alternatives provided for by this Act include well spacing, rotation of pumping, allocation of water, and moratoriums on drilling. The Act does not, however, address conjunctive use of surface water and groundwater, guidelines for management policies, and rights to artificially stored groundwater. (Sims-ISWS)
W80-02171

INDUCED GROUNDWATER RECHARGE IN THE GANGES BASIN,
Indian Inst. of Tech., New Delhi.
M. C. Chaturvedi, and V. K. Srivastava.
Water Resources Research, Vol 15, No 5, p 1156-1166, October 1979. 13 Fig, 4 Tab, 21 Ref, 1 Append.

Descriptors: *Groundwater, *Recharge, *Artificial recharge, *Model studies, Mathematical models, Analytical techniques, Rivers, Watersheds(Basins), Water table, Water levels, Drawdown, Pumping, Monsoons, Evapotranspiration, Flow, Streamflow, *India, *Ganges River Basin.

The Ganges basin in India has a serious problem of water availability. The basin area, which is only 1/12 that of the United States, has a population greater than the total U.S. population, and it is increasing at a rate of 2.5% per annum. About 77% of the population is engaged in agriculture, which is totally dependent on irrigation. Almost 85% of rainfall takes place in 2-3 monsoon months. Surface storage possibility is extremely limited, but groundwater recharge appears feasible, since sedimentary alluvial formations extend to depths of thousands of meters. Three alternative schemes of groundwater recharge were proposed. One involves pumping heavily along perennial rivers prior to monsoons so as to lower groundwaters to promote induced groundwater recharge. The second proposes a similar approach along nonperennial rivers. The third involves irrigation during monsoons with groundwater lowered adequately in the nonmonsoon period so that enough induced groundwater recharge takes place to provide adequate supplies for nonmonsoon months. A simulation-optimization model was developed to study the surface flow-groundwater interaction and was applied to study comparative cost effectiveness of the three alternate approaches. Sensitivity analysis was also carried out. It was shown that the third scheme is the most attractive. (Sims-ISWS)
W80-02176

DISTRIBUTION OF NITRATE AND RELATED NITROGEN SPECIES IN THE UNSATURATED ZONE, REDLANDS AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. M. Klein, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-300926, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-60, July 1979. 81 p, 28 Fig, 13 Tab, 93 Ref.

Descriptors: *Nitrogen compounds, *Nitrates, *Nitrogen, *Aquifer management, *Water pollution control, Groundwater, Water pollution sources, Fertilizers, Feed lots, Citrus fruits, Irrigation, Infiltration, Soil analysis, Baseline studies, Artificial recharge, Planning, Model studies, Evaluation, California, *San Bernardino County(Calif).

Nitrogen in the unsaturated soil zone in the vicinity of Redlands in San Bernardino County, Calif., has been suspected as the source of nitrate in water from wells. Plans have been made to recharge the aquifer with imported surface water. If this occurs, the rising water table will intercept soluble nitrate in the unsaturated zone. This study was made to quantify and delineate the distribution of the nitrate in the unsaturated zone. Thirteen test holes were drilled in areas of various land uses, and samples of the unsaturated-zone materials were obtained with depth. In 10 of the test holes, the maximum nitrate-nitrogen (N03--N) concentrations occurred within 10 feet of land surface suggesting N03--N sources at the surface. Ranking the test holes according to near-surface N03--N concentrations showed that, of the top six, only two are in irrigated citrus areas. One is in an abandoned feedlot. Of the lowest six, four are in irrigated citrus areas and one is in the Santa Ana River channel. The control test hole ranked fourth suggesting that relatively high N03--N concentrations can occur in near-surface soils even in the absence of human habitation. Analysis according to one conceptual model suggests that raising the water-table altitude by aquifer recharge will intercept N03--N now in the unsaturated zone causing increases in N03--N concentrations in water from wells of up to 48 milligrams per liter. The largest increases will occur in the vicinity of irrigated citrus areas. (Woodard-USGS).
W80-02233

4C. Effects On Water Of Man's Non-Water Activities

HYDROLOGIC DATA FROM URBAN WATERSHEDS IN THE TAMPA BAY AREA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. A. Lopez, and D. M. Michaelis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-301204, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-125, 1979. 51 p, 17 Fig, 12 Tab, 7 Ref.

Descriptors: *Urban hydrology, *Storm runoff, *Water quality, *Hydrologic data, Rainfall-runoff relationships, Evaporation, Land use, Data storage and retrival, *Tampa Bay area(Fla).

Hydrologic data are being collected in 10 urbanized watersheds located in the Tampa Bay area, Florida. The gaged watersheds have impervious areas that range from 19 percent for a residential watershed in north Tampa to nearly 100 percent for a downtown Tampa watershed. Land-use types, including roads, residential, commercial, industrial, institutional, recreational, and open space, have been determined for each watershed. Rainfall and storm runoff data collected since 1971 for one site and since 1975 for six other sites through September 1976, have been processed. These data are recorded at 5-minute intervals and are stored in the U. S. Geological Survey WATSTORE unit values file. Daily rainfall at 12 sites and daily pan evaporation at one site have been stored in the WATSTORE daily values file. Chemical and biological analyses of storm runoff for six sites, base flow for seven sites, and analyses of bottom material for seven sites are also stored in the WATSTORE water-quality files. Rainfall and storm runoff for selected storms, daily rainfall, and daily pan-evaporation data are summarized in this report. Water-quality analyses of all water-quality samples also are listed. (Woodard-USGS).
W80-02235

PROMISED LANDS, VOLUME 2: SUBDIVISIONS IN FLORIDA'S WETLANDS,
For primary bibliographic entry see Field 6G.

W80-02314

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TIME SERIES IN M DIMENSIONS: THE ONE-DIMENSIONAL CASE: POLLUTION IN THE CHICAGO SANITARY AND SHIP CANAL,
Western Illinois Univ., Macomb. Dept. of Mathematics.
D. B. Campbell, and D. J. Schaeffer.
Environmental Management, Vol 3, No 3, p 283-288, 1979. 6 Fig, 6 Tab, 11 Ref, 1 Append.

Descriptors: *Pollutants, *Monitoring, *Model studies, *Water pollution, *Nonstationary time series, *M-dimensional time series, *Chicago sanitary and ship canal, Dissolved oxygen, Dissolved solids, Nitrates, Nitrites, Ammonia, Sampling, Mathematical studies, Environmental monitoring, Water quality, Pollution, Regression model.

In order to examine the changes occurring at sampling stations on the Chicago Sanitary and Ship Canal (CSSC) a nonstationary time-series model is used. The Canal starts at Lake Michigan and runs into the Illinois River below Joliet. Primary indicators of the environmental health of the waterway are dissolved oxygen, ammonia, nitrates and nitrites, dissolved solids and coliform bacteria, dissolved oxygen being the most important. In this model the effects of several spatially and temporally separated points on some point of interest are examined. In order to be useful to, and be used by, the environmentalist, the model must be simple, insensitive to extremes, and responsive to changes occurring in the system. This method is insensitive to extreme values but responsive to overall changes in the system. The model successively predicted the behavior of such parameters as total dissolved solids and ammonia. The data, from 26 observations, were collected under difficult conditions and no more frequently than once a month and, particularly during the winter, weather conditions precluded the collection of any samples. Environmentally significant results were obtained. Accurate predictions of downstream sites could be made using 2-month-old data from upstream stations. From this it was determined that improvements in water quality, such as higher dissolved oxygen levels at the upstream end of the Canal, will significantly increase dissolved oxygen levels throughout the Canal. (Iervolino-NC)
W80-02023

PROFILE: ILLINOIS REDESIGNS ITS AMBIENT WATER QUALITY MONITORING NETWORK,
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
T. R. Wallin, and D. J. Schaeffer.
Environmental Management, Vol 3, No 4, p 313-319, 1979. 2 Tab, 23 Ref.

Descriptors: *Illinois, *Water quality control, *Monitoring, *Ambient water quality monitoring network, Ambient water quality, Lake Michigan(IL), Water analysis, Sampling, Water properties, Assessment, Water pollution, Cooperative agreements, Water pollution control.

Illinois' monitoring network has grown since 1957 from 150 stations to a network of 590 stations. The objectives of the Ambient Water Quality Monitoring Network (AWQMN) are: 1) to establish baselines of water quality; 2) to characterize and define trends in the physical, chemical, and biological condition of the state's surface waters; 3) to provide for a continuing assessment of water pollution control programs; 4) to identify and quantify new or existing water quality problems or problem areas; and 5) to act as a trigger mechanism for intensive surveys or other appropriate actions. Because objectives of the AWQMN were defined before it was designed, siting factors could be selected and priorities determined to best achieve those objectives. Ten site selection criteria were established, including at least one sampling site in each segment, networks of about 220 stations, availability of flow data, and maintenance of current data files. Sites with similar characteristics should be identified and grouped for analysis purposes. Each station can, therefore, be considered in one, two or more of seven sub-networks of the total AWQMN plan. The frequencies of sample collection are guided by the objectives of the AWQMN. Types of sampling include grab sampling, composite monitoring and automated continuous monitoring. The Illinois Environmental Protection Agency and the U.S. Geological Survey have a cooperative program under which USGS monitors a portion of the network and provides flow data at most network stations as well as extensive manpower training, equipment, data processing, and program quality control. Informal agreements with other agencies have permitted reduction in monitoring efforts required by the Illinois EPA. (Iervolino-NC)
W80-02024

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. LOWER COOK INLET INTERIM SYNTHESIS REPORT.
Science Applications, Inc., Boulder, CO.
NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Report July 1979. 257 p, 220 Ref.

Descriptors: *Resources development, *Environmental effects, *Baseline studies, Water pollution effects, Hazards, Transport, Biota, Oil pollution, Alaska, Sites, *Outer continental shelf, Cook inlet.

The Interim Edition of the Lower Cook Inlet Synthesis Report is intended to present a multidisciplinary overview of information relevant to possible Alaskan Outer Continental Shelf oil and gas development. OCSEAP-supported research is still continuing in the Lower Cook Inlet region, making additional relevant information continually available. A synthesis chapter is provided to tie the scientific and technical information chapters together. It presents a picture of the operation and vulnerability of the environmental system in such a way that the user, or 'decision maker', will have a sound basis for tract selection, location of pipelines or other facilities, stipulations, and regulations, or know where problems exist. (See W80-02054 thru W80-02059) (NOAA)
W80-02053

METHODS OF UTILIZATION OF WASTE EFFLUENTS FROM MINERAL FERTILIZERS PLANTS IN CARP FRY CULTURES,
Wyzsza Szkola Rolnicza, Szczecin (Poland). Dept. of Hydrozoology.
L. Szlauer.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 231-246, 1979. 2 Fig, 6 Tab, 9 Ref.

Descriptors: *Fertilizers, *Chemical wastes, *Fish farming, Fry, Carp, Industrial wastes, Zooplankton, *Phosphates, Nitrogen, Growth rates, Nutrients, Aquiculture, Daphnia, Phytoplankton.

Zooplankton and carp fry were cultured in chemical waste effluent containing up to 59.1 mg PO4 /1 and 86.1 mg N/1. A 100 per cent survival of fish and an increment in fish weight amounting to 1526 kg/ha was obtained in the course of 77 days of culturing carp fry in a pond without flow and with additional feeding with zooplankton cultured in waste effluent. Reduction of phosphates in waste effluent used in the cultures was up to to 90 per cent (on the average 2.97 mg PO4 /1/24h). (Deal-EIS)
W80-02078

EFFECT OF CRUDE OIL AND DETERGENT 'SOLO' ON THE ACTIVITY OF SOME HYDROLASES IN HEMOLYMPH OF CRAB RHITHROPANOPEUS HARRISI,
Medical Academy, Gdansk (Poland). Dept. of Biology.
G. Drewa, T. Dabrowska, Z. Zbytniewski, and F. Patuch.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 205-211, 1979. 4 Fig, 14 Ref.

Descriptors: *Enzymes, *Inhibition, *Oil, *Detergent, *Crabs, Animal metabolism, Animal physiology, Toxicity, Cruataceans, Biochemistry, Mortality, Chemical properties, Bioassay, *Surfactants, *Crude oil.

Activities of acid phosphatase and arylsulphatase in hemolymph of the crab Rhithropanopeus harrisi incubated for 2 weeks in solutions of curde oil and detergent 'SOLO' at concentrations of 50, 100 and 200 ppm were determined. Both crude oil and detergent decreased the activity of the investigated enzymes in crab hemolymph. Changes in the enzymic activity are probably due to the effect of the investigated pollutants on biological membranes and to their inhibition of lysosomal hydrolases. (Deal-EIS)
W80-02079

PREPARATION AND DETERMINATION OF CHLORAMINES FOR WATER TOXICOLOGY,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergentics.
M. Prus-Kaniewska, and H. Sztrantoicz.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 191-204, 1979. 3 Fig, 2 TAb, 17 Ref.

Descriptors: *Chemical properties, *Chlorination, *Waste treatment, Chemical reactions, Water temperature, Laboratory tests, Bioassay, Sodium compounds, Nitrogen compounds, Chorine, *Chloramines.

Mono-, di- and trichloramines were prepared using solutions of sodium hypochlorite of different concentrations and ammonium chloride with constant nitrogen concentration of 1.0 mg N/1. Various factors exerting an effect on the stability of chloramines (temperature, light, time) were studied. Contents of the different chloramines were determined by titration with Mohr's salt in the presence of orthotolidine. The stability of the obtained chloramine solutuions was found to be high, irrespective of light and temperarures. Curves of the obtained solutions were very consistent with the typical curve of chloramine formation. (Deal-EIS)
W80-02082

INFUENCE OF TEMPERATURE ON MORPHOLOGY AND PHYSIOLOGY OF SALMONID EMBRYOS, LARVAE AND ALEVINS,
Tikhookeanskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva i Okeanografii, Petropavlovsk-Kamchatskii (USSR).
L. P. Ryzhkov.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 397-425, 1979. 15 Fig, 14 Tab, 57 Ref.

Descriptors: *Water temperature, *Growth rates, *Salmonids, Oxygen requirements, Atlantic salmon, Rainbow trout, Animal metabolism, Fish physiology, Growth stages, Fry, Larval growth stage, Embryonic growth stage, Energy budget.

The influence of temperature on morphogensis rate, growth rate, oxygen consumption rate as well as on energy budget of 5 species of freshwater salmonid fishes (Salmo salar morpha sebago, Salmo ischchan typicus, Salmo ischchan gegarkuni, Salmo ischchan aestivalis and Salmo gairdneri) has been investigated for several years. Temperature increases stimulate the above processes, while a decrease in temperature makes them progress more slowly. Energy budgets are well balanced in the range of optimal temperatures. Deviations of temperature from the optimal temperatures. Deviations of temperature from the optimal range disturb the coordingation of energy budgets. The efficiency of utilisation of consumed food for growth decreases. (Deal-EIS)
W80-02085

THE EFFECT OF STARVATION AND TEMPERATURE CONDITIONS ON VENDACE (COREGONUS ALBULA L.) LARVAE,
Agricultural and Teachers Univ., (Poland). Inst. of Applied Biology.

B. Jezierska, M. Korwin-Kossakowski, and G. Jowko.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 387-395, 1979. 3 Fig, 20 Ref.

Descriptors: *Water temperature, *Toxicity, *Growth rates, Larval growth stage, Feeding rates, Mortality, Fry, Fish physiology, Fish management, Oxygen requirements, Fish diets, *Vendace, *Coregonus, Whitefish.

A determination was made of the effect of various thermal conditions (constant temperatures 10C and 18C as well as temperatures varying cyclically within 8C-18-8C) on larvae of vendace. At 18C the rate of morphogenesis was accelerated, but simultaneously larval mortality was high at this temperature. At 10C and at cyclically varying temperature the survival and development of larvae were similar. Furthermore, we determined the effect of various starvation periods on larvae kept at 10C; the 'point of no return' (PNR) was established at the 11th day after hatching. (Deal-EIS)
W80-02086

PHOTOPERIODIC ACCLIMATION AND CIRCADIAN VARIATIONS IN TOLERANCE OF JUVENILE RANBOW TROUT (SALMO GAIRDNERI) TO ZINC,
British Columbia Research Council, Vancouver. Div. of Applied Biology.
D. J. McLeay, and J. R. Munro.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 552-557, 1979. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Biorhythms, *Zinc, *Toxicity, *Photoperiodism, Fish physiology, Rainbow trout, Juvenile growth stage, Seasonal, Mortality, Diel migration, Heavy metals, Bioassay.

The intent of this study was to determine if circadian variations occur in the tolerance of juvenile rainbow trout to an acutely lethal concentration of zinc. Further, the influence of photoperiodic acclimation on this tolerance was examined since seasonal or photoperiodic acclimation may alter hormonal rhythms and toxic responses at a particular time of day; thus complexing the potential variations in acute lethal or sublethal aquatic toxicity data. Circadian variations in tolerance to zinc were evident. Fish acclimated to a natural photoperiod showed periods of maximum tolerance at 1200, 1600-1800 and 2400-0200 h; and periods of maximum sensitivity at 1400 and 2000 h. Those acclimated to a fixed summer photoperiod showed maximum tolerances at 1800 and 0600-0800 h; and maximum sensitivities at 1400 and 0400 h. (Deal-EIS)
W80-02087

DETECTION LIMITS OF A BIOLOGICAL MONITORING SYSTEM BASED ON FISH RESPIRATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
W. Slooff.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 517-523, 1979. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Monitoring, *Respiration, *Bioassay, Toxicity, Fish physiology, Rainbow trout, Analytical techniques, *Cadmium, *Copper, Organic compounds, Phenols, Laboratory tests, Cyanide, Xylene, Toluene , Pentachlorophenol.

In order to assess the detection limits of a method of monitoring fish respiratory rate, fish were exposed to one of thirteen organic or inorganic compounds at one of three different concentrations. The monitoring technique employs dual external electrodes to detect respiratory activity. In most cases the toxicants caused an increase in the breathing rate of the fish at sublethal concentrations. These responses were obtained more frequently during the dark photoperiod. The system was found to be much more sensitive than the 48th LC50. Detection thresholds varies from 1 to 30% of the 48h LC50 toxicant concentration. (Deal-EIS)
W80-02088

EFFECTS OF A THERMAL DISCHARGE ON THE MORTALITY OF COPEPODS IN A SUBTROPICAL ESTUARY,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
R. W. Alden, III.
Environmental Pollution, Vol 13, p 3-19, 1979. 3 Fig, 2 Tab, 40 Ref.

Descriptors: *Copepods, *Mortality, *Heated water, Water temperature, Thermal pollution, Thermal stress, Lethal limit, Estuarine environment, Adaptation, Evolution, Heat resistance, Tropical regions, Animal populations, Seasonal, Powerplants, Thermal discharges.

Experimental field treatments were employed to examine the thermal mortalities of copepods exposed to the heated effluents of a power generating plant located on a subtropical estuary. Significant lethal effects were observed for all species studied, with mass mortalities occurring during the warmest months of the year. Of the seven species examined, the copepods identified as estuarine species had steeper mortality curves and higher upper lethal thermal limits than the more neritic forms. The estuarine species have apparently evolved the ability to live in subtropical areas under temperature conditions very close to their upper thermal limits. Coastal species, on the other hand, exhibit a greater variation in temperature sensitivity so thermal additions in subtropical estuaries could be very significant in limiting their distribution and abundance. (Deal-EIS)
W80-02091

PHYSIOLOGICAL AND ENVIRONMENTAL CONSTRAINTS IN THE ECOLOGY OF THE PLANKTONIC DINOFLAGELLATE CERATIUM HIRUNDINELLA,
Freshwater Biological Association, Windermere (England).
G. P. Harris, S. I. Heaney, and J. F. Talling.
Freshwater Biology, Vol 9, p 413-428, 1979. 8 Fig, 1 Tab, 60 Ref.

Descriptors: *Dinoflagellates, *Ecology, *Habitats, Thermal stratification, Dissolved oxygen, Photosynthesis, Chlorophyll, Plankton, Aquatic microorganisms, Epilimnion, Light intensity, Light penetration, Aquatic populations, Nitrogen, Seasonal, Esthwaite water.

Constraints upon the vertical distribution of a population of Ceratium hirundinella, in a productive English lake during the summer stratification of 1976, are considered. They are interpreted in relation to vertical gradients of temperature, dissolved oxygen and irradiance, and to rates of photosynthesis and respiration measured as oxygen exchange in long- and short-term exposures. The motile cells tended to aggregate at an intermediate depth in the epilimnion, associated with a relative irradiance level of c. 10%. Higher irradiances, and conditions below the oxycline, were apparently unfavourable, but the intervening layer was severely compressed at the height of summer stratification, when concentrations of inorganic nitrogen were also minimal. Thus the population apparently passed through a critical period, at which the cellular content of chlorophyll-a was much reduced. The preferred irradiance level in the lake corresponded to that at which measured rates of net photosynthesis were maximal. Increased rates of oxygen evolution were measured at higher irradiances in very short exposures; this behaviour may be of importance to cells experiencing vertical movement in nature. (Deal-EIS)
W80-02092

ADAPTATION OF A RECIRCULATING FISH CULTURE SYSTEM TO SALINITY CHANGE,
Biologische Anstalt Helgoland, Hamburg (Gemany, F.R.).
H. Rosenthal, and G. Otte.
Meeresforschung, Vol 27, No 3, p 203-206, 1979. 2 Fig, 10 Ref.

Descriptors: *Salinity, *Trickling filters, Ocidation, *Salt tolerance, *Aquiculture, Biochemical oxygen demand, Filtration, Ammonium, NItrification, Biodegradation, Bacteria, Methodology, Waste treatment, Fish establishment, Fish hatcheries.

The reaction of a biological filter (integrated in a recycling sytstem for fish culture) to salinity change (2 o/oo S/d from 0 to 8 o/oo) was investigated. Theoxidation of easy digestible carbon compounds (measured as BOD) was unaffected whereas the decomposition processes for low biodegradable substances ceased during salinity increase but was reactivated slowly after the final salinity level had been reached. Nitrification was significantly affected during the first 3 days with an ammonium peak followed by a nitrate maximum 12 h later. While ammonium oxidation regained its former efficiency during the period of salinity increase, nitrite oxidation was still unbalanced 6 days after the final salinity had been reached. (Deal-EIS)
W80-02095

DEVELOPMENT OF ALGAE IN PONDS TREATED WITH FOSCHLOR AND IN PONDS WITH CONTROLLED TIME OF FILL,
Instytut Rybactwa Srodladowego, Zibieniec (Poland). Pond and River Dept.
M. Januszko.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 247-256, 1979. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Pesticide toxocity, *Aquatic algae, *Fish farming, Ponds, Fish management, Chlamydomonas, Scendesmus, Chlorella, Diatoms, Dominant, Organisms, Growth rates, Inhibition, Biomass, Algal control.

A study was made on the effect of foschlor R-20 1 mg AI/1 on the quantity and biomass of algae in ponds. Foschlor first reduced rapidly and then stimulated the development of Stephanodiscus Hantzchii and Cryptomonas rostrata, Chlamydomonas sp. and Chlorella minutissima were affected slighter. It seems that Chlamydomonadacea, Scenedesmus quadricauda and Nitschia palea remained unaffected. Since the selective action period was rather short, foschlor did not change the succession of algal species. The succession was very similar both in the treated and control ponds. (Deal-EIS)
W80-02096

EFFECT OF COPPER SULFATE AND SODIUM PENTACHLOROPHENATE ON ADENINE AND ADENOSINE PHOSPHATES IN LYMNAEA LUTEOLA (MOLLUSCA: GASTROPODA),
Sri Venkateswara Univ., Tirupati, (India). Dept. of Zoology.
V. D. Chowdary, P. V. Rao, and R. Narayanan.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 615-619, 1979. 1 Tab, 20 Ref.

Descriptors: *Copper sulfate, *Toxicity, *Snails, *Enzymes, Sodium compounds, Inhibition, Animal metabolism, Proteins, Biochemistry, Chemical analysis, Pesticides, Mode of Action, Phosphates, *Sodium Pentachlorophenate, *Tissue analysis.

Although copper sulfate and sodium pentachlorophenate have been used as molluscicides for many years little is known of its exact modes of action. In this research the effects of these two compounds on adenylate compounds in the freshwater snail (Lymnaea luteola) were studied. Specimens were exposed to either 2 ppm copper sulfate for 15 hours or 2 ppm sodium pentachlorophenate for 10 hours (plus controls). Following exposure the animals were analyzed for adenine and adenpsine phosphatease activity. Snails exposed to CuS04 for 15 h could maintain 92% of the normal ATP level, while it was 72% for NaPCP treated snails. In the CuS04 treatment the ATP/ADP ratio remained unchanged while the ATP/AMP ratio increased. In NaPCP treatment both the parameters decreased. The adenine+adenosine fractions decreased on CuS04 treatment and increased on NaPCP treatment. (Deal-EIS)
W80-02097

THE INFLUENCE OF AMMONIA WATER ON BACTERIA, PLANKTON AND BOTTOM FAUNA OF PONDS, (IN POLISH),
Instytut Rybactwa Srodladowego. Warsaw (Poland).
E. Grygierek, M. Januszko, D. Kruger, and B. E. Wasilewska.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 212-240, 1978. 11 Fig, 2 Tab, 9 Ref.

Descriptors: *Ammonia, *Toxicity, *Plankton, *Bacteria, *Benthic fauna, Phytoplankton, Zooplankton, Mortality, Water chemistry, Ponds, Seasonal, Growth stages, Hydrogen ion concentration, Water temperature, Mode of action.

Studies were carried out on the influence of ammonia water introduced in amounts of 1.-1.5 tons/ha on the biocenosis of a pond. From 0.4 to 37 mg/1 of non-ionized ammonia- the toxic fraction of ammonia - was obtained in particular cases. Amounts of 2.5-2.8 mg/1 of non-ionized ammonia were found to be lethal for phytoplankton and zooplankton. No influence of the amount of ammonia water introduced on bottom fauna was observed. No changes in the amount of bacteria in the water took place in winter, whereas the amount of bacteria increased in the pond bottom. Ammonia water can be used as a measure for changing the biocenosis structure toward rejuvenation of complexes, but has no disinfecting effect. (Deal-EIS)
W80-02099

AN EVALUATION OF THE USEFULNESS OF A POND ENVIRONMENT WITH HEATED WATER FOR REARING OF FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland).
E. Grygierek, M. Januszko, D. Kruger, K. Migala, and B. E. Wasilewska.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 97-119, 1978. 3 Fig, 5 Tab, 56 Ref.

Descriptors: *Heated water, *Toxicity, *Aquatic populations, *Aquiculture, Trophic level, Productivity, Thermal pollution, Cooling waters, Powerplants, Water temperature, Fish management, Zooplankton, Phytoplankton.

Studies were conducted on the influence of heated water from an electric power plant on the biocenosis of fish ponds. It was found that at a water temperature of up to 22-23C biological and physico-chemical parameters are not influenced. However a water temperature of more than 23C over a longer period of time results in unfavourable changes in the structure of the biocenosis due to the excessively high activity of consumers with respect to the regeneration possibilities of their prey. Recommendations are made on the type of pond conditions best suited to culturing yearling fish. (Deal-EIS)
W80-02101

EFFECTS OF TOXIC AMOUNTS OF DIETARY ZINC ON THE GROWTH AND BODY COMPONENTS OF RAINBOW TROUT AT TWO LEVELS OF CALCIUM (IN JAPANESE).
Freshwater Fisheries Research Lab., Tokyo (Japan).
H. Takeda, and Y. Shimma.
Bulletin of the Freshwater Fisheries Research Laboratory, Vol 27, No 2, p 103-110, 1977. 1 Fig, 3 Tab, 18 Ref, 1 App. (English summary).

Descriptors: Metals, *Zinc, *Calcium, *Aquiculture, Protein, *Fish diets, Fish physiology, *Rainbow trout, Freshwater fish, Dietary zinc, Zinc accumulation, Magnesium.

Nine lots of rainbow trout fingerlings were raised on casein diets for 6 weeks in order to determine their response to high levels of dietary Zn (50-2,000 ppm) at two levels of dietary Ca (0.01 and 0.5%). Calcium was also added to the SCP diet (300 ppm Zn) composed mainly of yeast grown on acetic acid. Zinc oxide and Ca-lactate were used as the sources of the two minerals. The fish on the casein diets showed inferior growth and feed efficiency only when the diet contained 2,000 ppm of Zn and 0.01% Ca, while those on the 2,000 ppm Zn diet with 0.5% Ca supplement grew as well as the other lots. Other protective effects of supplemental Ca against the adverse effects of excess amounts of dietary Zn were observed clearly in the Zn concentrations in the bone and the whole body in the case of 1,000 ppm Zn diets. The results from 400 ppm to 700 ppm, over which the accumulation of Zn in the fish body was accelerated. Addition of Ca to the SCP diet of 300 ppm Zn showed no beneficial effect on fish growth at all. (Deal-EIS)
W80-02102

AN ATTEMPT TO DISINFECT FISH PONDS WITH AMMONIA WATER (IN POLISH),
Instytut Rybactwa Srodladowego, Warsaw (Poland).
S. Danielewski.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 69-80, 1978. 5 Fig, 3 Tab, 10 Ref.

Descriptors: *Ammonia, *Toxicity, *Disinfectants, Aquiculture, Ponds, Water chemistry, Hydrogen ion concentration, Water temperature, Fishkill, Benthic fauna, Carbonates, Calcium, Nitrates, Nutrients, Seasonal, Fish management, Water quality.

Possibilities of using ammonia water for disinfecting fish ponds were tested. Disinfecting actions of ammonia water consist of toxic effect of ammonia upon living organisms but not an increase of the pH value noted in the case of NH4ON. In soft and alkaline waters, as also in increased temperatures, ammonia water is characterized by a stronger toxic effect. Dosage of one ton of 20% N ammonia water per 1 ha of pond destroys the fishes and also partly lower water organisms. In autumn and winter the decrease of ammonia content to pretreatment levels lasted two months, in spring - one month, and in summer even less. Introduced amounts of NH3 resulted in changes in the water chemistry: drop of carbonates and calcium, increase of the pH value and nitrate content. Ammonia water used for disinfection also had fertilizing effects. (Deal-EIS)
W80-02103

THE SENSITIVITY OF FISH EMBRYOS TO THE EFFECT OF TOXICANTS,
Moscow State Univ. (USSR). Special Topics Lab.
O. P. Danil'chenko.
Journal of Ichthyology, Vol 7, No 3, p 455-463, 1977. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Toxicity, Bioassay, Reproduction, *Fish eggs, Water pollution effects, Methods, *Organic metal compounds, Metals, Triethyl stannic chloride, Pentachlorophenol, Yellow Perch, Sturgeons, *Fish embryos, Hatching success, Early developmental stages, Juvenile fish, Juvenile growth stages, Salicyl anilid.

An investigation was made of the embryonic development of teleosts and sturgeons in solutions of various toxicants and of the reversability of the effect of lethal concentrations of triethyl stannic chloride. It was demonstrated that fish embryos are simultaneously highly resistant to the action of the toxicant and highly sensitive to it. The resistance of fish eggs to the action of toxicants should be understood as the possibility of completing development at relatively high concentrations. The sensitivity of fishes in the embryonic development period to the action of toxicants is manifested as various deviations from the control in embryos, prolarvae and larvae when they develop in nonlethal solutions of a toxicant. (Katz-EIS)
W80-02104

THE INFLUENCE OF INCREASED O2 CONCENTRATIONS ON THE SURVIVAL AND HATCHING OF THE EMBRYOS OF THE BREAM, ABRAMIS BRAMA,
Akademiya Nauk SSSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
M. V. Gulidov, and K. S. Popova.
Journal of Ichthyology, Vol 17, No 1, p 174-177, 1977. 2 Fig, 4 Tab, 5 Ref.

Descriptors: *Oxygen, *Aquiculture, *Fish physiology, *Supersaturation, Laboratory tests, Bioassay, Freshwater fish, Bream, Fish eggs, Fish farming, Fish reproduction, Growth, Times of hatching.

A study was conducted to determine the effect of oxygen supersaturation on the survival and hatching of the bream, Abramis brama. The percent of normal embryos that hatched was similar at saturation 9.2 ppm D.O. and at supersaturation 17.6 and 33.7 ppm D.O. Embryos were largest at 33.7 ppm D.O. At all oxygen concentrations there was a similarity of developmental defects in abnormal embryos (Katz-EIS)
W80-02105

TEMPERATURE DEPENDENCE OF ACTIVE METABOLISM AND SWIMMING SPEED OF THE BAIKAL GRAYLING, THYMALLUS ARCTICUS BAICALENSIS,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Physiology.
A. Ya. Stolbov, and Yu. S. Alikin.
Journal of Ichthyology, Vol 17, No 1, p 178-179, 1979. 1 Tab, 6 Ref.

Descriptors: *Water temperature, *Fish physiology, Biochemistry, Fish behavior, Oxygen, *Oxygen requirements, Grayling, Laboratory tests, Active metabolism, *Swimming speed, Temperature, Temperature effects.

The rate of general metabolism in fish at rest depends directly on the temperature of the environment. The influence of temperature on oxygen consumption of the Baikal grayling at different speeds of swimming was investigated. It was determined that energy expenditure on the performance of external mechanical work during the swimming of the grayling at different speeds of swimming was investigated. It was determined that energy expenditure on the performance of external mechanical work during the swimming of the grayling does not depend on water temperature. (Katz-EIS)
W80-02106

AN ASSESSMENT OF KNOWLEDGE CONCERNING THE FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. W. Anderson.
In: Marine Pollution, Functional Responses. (Vernberg, W. B., Calabrese A., Thurberg F.P., and Vernberg, F. J., Eds, Academic Press, NY.). p 3-21, 1979. 37 Ref.

Descriptors: *Oil, *Oil spills, *Water pollution effects, Path of pollutants, *Toxicity, *Mortality, Bioassay, Laboratory tests, On site investigations, Biochemistry, Animal physiology, Animal biochemistry, Petroleum hydrocarbons, Oysters, Monitoring, Tissue contamination, Bioaccumulation.

The amount of data accumulated from laboratory and field investigations regarding the environmental effects of petroleum hydrocarbon spills allows a good understanding of this problem. Considerable knowledge is available regarding the acute toxicity and the effects of sublethal concentration of petroleum on a variety of vertebrate and invertebrate organisms. The uptake and release of petroleum hydrocarbons by marine and estuarine molluscs suggests their use for field monitoring of sediment-bound petroleum hydrocarbons by aquatic organisms. (Katz-EIS)
W80-02107

THE EFFECT OF NAPHTHALENE ON SYNTHESIS OF PEPTIDE ANTIFREEZE IN THE BERING SEA SCULPIN, MYOXOCEPHALUS VERRUCOSUS,
Illinois Univ. at Urbana-Champaign. Dept. of Physiology and Biophysics.
A. L. DeVries.
In: Marine Pollution, Functional Responses, W. B. Vernenberg, A. Calabrese, F. P. Thurberg, and F. J. Vernberg, Eds. Academic Press, NY. p 54-67,

1979. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Oil, Oil spills, *Water pollution effects, Path of pollutants, *Marine fish, Biochemistry, Fish physiology, Animal pathology, Laboratory tests, Bioassays, Petroleum hydrocarbons, *Napthhalene, Chemical analysis, Kidney function.

A study was made of the effect of petroleum hydrocarbon naphthalene on the physiology and biochemistry of selected Bering Sea fishes at lethal and sublethal concentrations. This substance appears to accumulate in the liver so a study was made to determine its effect on liver protein synthesis. Laboratory experiments indicated that although there was cellular determination, the lives has a large synthetic capacity that can handle the synthetic requirements of both the mixed function oxidase system and the plasma proteins at the same time. (Katz-EIS)
W80-02108

PESTICIDES: THEIR IMPACT ON THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
D. R. Nimmo.
In: Marine Pollution, Functional Responses, W. B. Vernberg, A. Calabrese, F. P. Thurberg, F. J. Vernberg, Eds. Academic Press, NY. p 259-270, 1979. 1 Tab, 37 Ref.

Descriptors: *Insecticides, Pesticides, Aroclor, *Polychlorinated biphenyls, *DDT, DDE, Estuaries, Chlorinated hydrocarbon pesticides, *Environmental effects, Pyrethroids, Animal physiology, Animal pathology, Herbicides.

The impacts of synthetic organic pesticides on the estuarine environment is discussed. It is observed that pesticides, particularly DDT and its metabolites are still observed six years after large scale use ceased in one watershed. The longevity of persistent pesticides, PCB, in an estuary has been demonstrated in oysters. New pesticides belonging to different chemical groups are being developed and used and knowledge regarding their environmental impacts should be accumulated and applied. (Katz-EIS)
W80-02109

COMPARATIVE METABOLISM OF PARATHION BY INTERTIDAL INVERTEBRATES,
California Univ., Davis. Dept. of Environmental Toxicology.
R. L. Garnas, and D. G. Crosby.
In: Marine Pollution, Functional Responses, W. B. Vernberg, A. Calabrese, F. P. Thurberg, and F. J. Vernberg, Eds. Academic Press, NY. p 291-305, 1979. 3 Fig, 2 Tab, 30 Ref.

Descriptors: Bioassay, Toxicity, *Biochemistry, *Animal physiology, Mussels, Molluscs, Benthos, Marine animals, Insecticides, *Parathion, *Organophosphorous pesticides, Starfish, Sea anemone, Laboratory tests, Absorption, Metabolism, Metabolites.

A laboratory study was made of the metabolism of parathion by the sea star, the California mussel, the black turban snail and the sea anemone. Using radioactive techniques the uptake of the pesticide by the various organisms was correlated. The subsequent metabolism and degradation of the parathion was observed and measured. The metabolism of the pesticide involved typical metabolic pathways of oxidation, reduction and hydrolysis. (Katz-EIS)
W80-02110

MULTIPLE FACTOR INTERACTIONS AND STRESS IN COASTAL SYSTEMS: A REVIEW OF EXPERIMENTAL APPROACHES AND FIELD IMPLICATIONS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
In: Marine Pollution, Functional Responses, W. B. Vernberg, A. Calabrese, F. P. Thurberg, F. J. Vernberg, Eds. Academic Press, NY. p 389-414, 1979. 8 Fig, 1 Tab, 64 Ref.

Descriptors: *Toxicity, *Bioassay, *Water temperature, Water quality, *Salinity, Estuaries, Apalachicola Bay, Florida, Stress, Chlorine, Estuarine environment, Animal groupings, Animal populations, Stress, Benthos, Species diversity, Microcosms, Simulated ecosystems.

An attempt is made to extrapolate toxicity bioassay data to field situations where environmental response depends upon more than one factor. A critical review is made of multiple factor interactions with particular attention to the nature of stress in estuarine and coastal systems. The complexity of interacting factors is made evident by recent studies concerning the fate and effects of chlorine in coastal systems. The chlorine problem involves at least environment persistence of the substance, identification of degradation products, results of toxicity bioassays, the determination of appropriate water quality parameters and the design of experimental approaches that will assist in provided useful action. Studies in the Apalachicola estuary are used to provide illustrative data. (Katz-EIS)
W80-02111

TEST OF A MODEL FOR PREDICTING KEPONE ACCUMULATION IN SELECTED ESTUARINE SPECIES,
Environmental Research Lab., Gulf Breeze, FL.
L. H. Bahner, and J. L. Oglesby.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 221-231, 1979. 6 Fig, 1 Tab, 7 Ref.

Descriptors: *Pesticide kinetics, *Pesticide residues, Bioassay, Oysters, Shrimp, Crabs, Food chains, Absorption, Mathematical models, Chemical properties, Water chemistry, Estuarine environment, Animal metabolism, Analytical techniques, Path of pollutants, *Kepone, *Depuration, *Bioconcentration.

Extensive testing has shown that Kepone is rapidly accumulated by estuarine animals when administered in water or food. Flow-through laboratory experiments with oysters, shrimp, crabs, and fish indicate that the food-chain transfer of Kepone is important in predicting Kepone residues in estuarine organisms. The rates of Kepone movement through estuarine organisms were previously unknown; rates of uptake and depuration by these organisms were determined with a regression model that describes mathematically the uptake and depuration of Kepone by these organisms. The model describes biological data as a single equation, thus allowing variations, due to many physical, chemical, biological, and random-error factors, to be analyzed simultaneously. The direct application of this model to cautious extrapolation will aid administrative decisions that affect water quality. The rates calculated by this single-species model can be also used in developing models that can predict the long-term fate of Kepone or of other pollutants in an estuarine environment. (Deal-EIS)
W80-02113

CONSIDERATIONS IN ASSESSING THE POTENTIAL FOR, AND SIGNIFICANCE OF, BIOMAGNIFICATION OF CHEMICAL RESIDUES IN AQUATIC FOOD CHAINS,
EG and G Bionomics, Wareham, MA.
K. J. Macek, S. R. Petrocelli, and B. H. Sleight, III.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 251-268, 1979. 1 Fig, 6 Tab, 29 Ref.

Descriptors: *Food chains, *Organic compounds, *Chemical wastes, Path of pollutants, *DDT, *Cadmium, *Endrin, Pesticide residues, Water chemistry, Absorption, Chemical analysis, Chemical properties, Aquatic environment, *Biomagnification, *Bioaccumulation, *Tissue analysis, *Leptophos, *Kepone, *Bioconcentration, *Depuration.

The relative importance of dietary and aqueous exposure of bluegill sunfish to di(2-ethylhexyl) phthalate, 1,2,4-trichlorobenzene, and leptophos are quantitatively evaluated at steady state. The results of this investigation indicate that the incremental steady-state body burden due to dietary exposure is statistically indistinguishable from that due to aqueous exposure. Critical analyses of similar studies with cadmium, endrin, and Kepone support the hypothesis that biomagnification of chemical residues within aquatic food chains is quantitatively insignificant when compared with the process of bioconcentrations of chemical residues directly from water. Dichlorodiphenyltrichloroethane (DDT) appears to be the only chemical of those evaluated with a potential for significant accumulation of residues through an aquatic food chain. Data on the biological persistence of chemicals in aquatic organisms, as measured by the rate of depuration from tissues, appear to offer a mechanism for identifying those few chemicals which may have potential for measurable accumulation through food chains. All of the data presented indicate that the process of biomagnification, as classically defined, probably does not occur within communities of aquatic organisms. (Deal-EIS)
W80-02115

EXPOSURE ASSESSMENT: A KEY ISSUE IN AQUATIC TOXICOLOGY,
Environmental Research Lab., Athens, GA.
W. M. Sanders, III.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 271-283, 1979. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Bioassay, *Methodology, *Analytical techniques, Laboratory tests, Mathematical models, Chemical properties, Chemical analysis, Monitoring, Chemical degradation, Microbial degradation, Path of pollutants, Aquatic environment, Organic compounds, Pesticides.

Environmental exposure assessment is a new and emerging science, and, although some processes have not been adequately characterized, tests for the most significant ones (volatilization, hydrolysis, oxidation, etc.) are available. Both screening tests and detailed protocols are presently available for determining the process kinetics for selected chemicals exposed to differing environmental conditions. Preliminary exposure assessments can be made from the screening data if the following rate processes are estimated: microbial degradation, chemical transformation, photolysis, hydrolysis, ionization, and partitioning. Because these processes can act either synergistically or competitively, depending upon the chemical structure of the material and the conditions of the environment, great care must be taken to conduct the tests in sequential order. The greatest unrealized potential for exposure assessment lies in the use of mathematical modeling techniques. When environmental exposure models are coupled with environmental effects models, powerful tools for risk assessment emerge. Such sophisticated models need to be refined and verified, however, before risk analysis becomes accurate and cost effective. (Deal-EIS)
W80-02116

AN APPROACH TO THE TOXICOLOGICAL EVALUATION OF A COMPLEX INDUSTRIAL WASTEWATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. G. Pearson, J. P. Glennon, J. J. Barkley, and J. W. Highfill.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 284-301, 1979. 6 Tab, 14 Ref.

Descriptors: *Chemical wastes, *Explosives, *Methodology, Bioassay, Chemical properties, Water quality, Analytical techniques, Industrial wastes, Organic compounds, Chemical analysis, Daphnia, Minnows, Toxicity, *TNT, *Mutagens.

The U.S. Army is currently conducting research to develop the data base required to establish water quality criteria for wastewater discharged from 2,4,6-trinitrotoluene (TNT) production facilities. Because over 30 munitions-related compounds are

involved, a traditional compound-by-compound approach to the toxicological evaluation of this complex wastewater was considered both technically unacceptable and economically prohibitive. An alternate approach was developed that placed research emphasis on the toxicological evaluation of a representative wastewater mixture. The initial task, therefore, was to conduct a detailed wastewater chemical characterization study over a period of several months. Wastewater constituents were identified and quantified, and, through the use of statistical procedures, a mixture representative of the actual wastewater was defined. Only 22 of the compounds identified in the actual wastewater were detected consistently above the parts-per-billion detection limit. These were included in the mixture designated for detailed toxicological testing. To identify possible trace constituents with extraordinary toxicological properties, all the identified compounds received screening-type toxicological testing. We believe that this combined approach of a single compound and moisture testing provides both an economical and scientifically acceptable approach to the development of water quality criteria for complex industrial wastewaters that remain relatively constant over time. (Deal-EIS)
W80-02117

INTERPRETATION OF CHEMICAL WATER QUALITY DATA,
Colorado State Univ., Fort Collins.
G. F. Lee, and R. A. Jones.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials. STP 667, p 302-321, 1979. 15 Ref.

Descriptors: *Water quality, *Methodology, *Reliability, Water quality standards, Testing procedures, Analysis, Analytical techniques, Bioassay, Data collections, Estimating, Chemical properties, Mode of action, Water chemistry.

Meaningful interpretation of water quality data requires an evaluation of the reliability of the data. Particular attention must be given to evaluation of the applicability of the analytical methods used, sampling and sample handling procedures, and analytical quality control program. There are many problems with the use of the U. S. Environmental Protection Agency (EPA) water quality criteria as a basis for evaluating water quality. Meaningful interpretation of data requires consideration of the concentation-time of the exposure relationships that exist at a given location within a body of water where the concentration of a chemical is in excess of the U. S. EPA criterion. Also, consideration must be given to the amount of the contaminant which is available to affect water quality. This may require the use of bioassay procedures since, in general, chemical procedures provide a relatively poor estimate of the amount of available contaminant present in a water sample. In addition, consideration must be given to the physical and chemical characteristics of the water since they may markedly affect the significance of a chemical contaminant for water quality. (Deal-EIS)
W80-02118

EFFECTS OF CALCIUM AND SEDIMENT CONCENTRATIONS ON THE RELEASE OF METALS AND NUTRIENTS FROM DREDGE SPOIL DISPERSIONS,
Corps of Engineers, Detroit, MI. Detroit District.
F. L. Snitz, W. J. Weber, Jr., J. L. Barney, and J. C. Posner.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 322-341, 1979. 8 Fig, 4 Tab, 25 Ref.

Descriptors: *Dredging, *Sediments, *Metals, *Nutrients, Calcium, Water chemistry, Great lakes, Suspended solids, Magnesium, Cadmium, Copper, Lead, Zinc, Iron, Manganese, Chromium, Phosphates, Nitrogen, Channel improvement, *Arsenic.

Sediment from the lower Cuyahoga River (5.8 river km from the mouth at Lake Erie) was dispersed in reactors containing simulated lake water constituted to have pH, dissolved oxygen (DO), alkalinity, and hardness values typical of Great Lakes Waters. The parameters of pH and DO were maintained constant during the course of the experiments, while calcium and sediment dispersion concentrations were systematically varied. The calcium ranged from 5 to 120 mg/litre and the sediment from 0.5 to 50 g(dry)/litre. The materials investigated for release from the sediment dispersions included magnesium, cadmium, copper, lead, zinc, iron, chromium, arsenic, total dissolved phosphate as PO4, and total Kjeldahl nitrogen. In general, the extent of release was inversely related to the calcium and sediment concentrations. Significantly, the unit release of metals and nutrients in oxygenated waters increased two to five-fold with each order-of-magnitude decrease in sediment dispersion concentration. The methods of the research bear upon the development of procedures for evaluating the potential impact of dredging operations on water quality. The results of this investigation show that the amounts of dredge spoil constituents released into solution can be comparable in magnitude to those of dissolved mineral species in rivers and outfalls. (Deal-EIS)
W80-02119

TRANSPORT AND TRANSFORMATIONS OF ANTHRACENE IN NATURAL WATERS,
Oak Ridge National Lab., TN.
G. R. Southworth.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials STP 667, p 359-380, 1979. 5 Fig, 5 Tab, 15 Ref.

Descriptors: *Path of pollutants, *Microbial degradation, *Aquatic environment, Aromatic compounds, Fuels, Chemical properties, Chemical analysis, Biodegradation, Chemical degradation, Sediments, Daphnia, Minnows, Zooplankton, *Anthracene, *Bioaccumulation, *Tissue analysis.

Polycyclic aromatic hydrocarbons (PAH) commonly occur in wastes from pyrolysis of biogenic fuels. Because some PAH are known carcinogens, an understanding of their environmental behavior and persistence is critical to determining their potential hazard to man. While many processes may remove or transform PAH in aquatic ecosystems, several may be particularly important in determining the fate of PAH in most systems. Laboratory measurement of the rates of various processes under controlled conditions are identifying those critical parameters of environmental transport where more detailed research is necessary. Anthracene was selected as a representative PAH because of its intermediate molecular weight and its lack of carinogenicity. The rate of photolysis, hydrolysis, volatilization, and microbial degradation of anthracene were measured under different environmental conditions, using fluorimetric and radiotracer techniques. The equilibrium constants for processes such as sorption and bioaccumulation were also determined. The results of the study indicated that photolysis and microbial degradation within the water column are likely to be the dominant pathways of anthracene removal from aquatic systems. More research is needed to ascertain the degree to which the microbial degradation rates observed in this study are representative of other PAH-contaminated systems. (Deal-EIS)
W80-02121

THE EFFECT OF PLANTS AND ANIMALS ON THE CHEMISTRY OF ESTUARINE SEDIMENTS,
Cape Town Univ. (South Africa). Dept. of Zoology.
J. H. Day.
In: Biogeochemistry of Estuarine Sediments, Proceedings of a Unesco/SCOR Workshop held in Melreux, Belgium, 29 November to 3 December 1976, p 216-221, 1978. 8 Ref. Unesco, Paris, France.

Descriptors: *Geochemistry, *Benthic fauna, *Benthic flora, *Bottom sediments, Estuarine environment, Biochemistry, Chemical analysis, Nutrients, Aquatic plants, Aquatic algae, Oxygen, Trace elements, Food chains, Detritus, Burrows, Decomposing organic matter, Diatoms, Crustaceans, Zooplankton, *Bioturbation, *Bioconcentration, *Polychaetes.

In this paper the biogeochemistry of estuarine sediments are studied for the effects of higher plants and animals. These organisms are a source of organic detritus, including the substrates upon which the bacteria depend. Complex organic molecules are oxidized or reduced and simple substances are released including plant nutrients - which are taken up by the roots of vascular plants or diffuse into the water column where they can be absorbed by algae. There are many other changes as well. Both plant roots and burrowing animals carry down oxygen into the sediments and simple organic compounds diffuse into the interstitial waters. Trace metals are absorbed and usually concentrated by living organisms, including migratory fish and birds which transport them out of the estuary. Possibly the most important changes are due to bioturbation by burrowing animals which bring up material from the reduced subsurface layers to be oxidised on the surface and thus replenish continuously the intersitial waters. (Deal-EIS)
W80-02122

CRITICAL FACTORS IN THE TRANSPORT OF LIVING FRESHWATER FISH--I. GENERAL CONSIDERATIONS AND ATMOSPHERIC GASES,
Ministry of Agriculture, Fisheries and Food, London (Endland). Salmon and Freshwater Fisheries Lab.
A. L. Taylor, and D. J. Solomon.
Fisheries Management, Vol 10, No 2, p 27-32, 1979. 3 Fig, 15 Ref.

Descriptors: *Fish management, *Fish physiology, *Fish behavior, Fish diseases, Salinity, Water temperature, Dissolved oxygen, Toxicity, Oxygen requirements, Mortality, Fish stocking, Water chemistry, Carbon dioxide, *Fish transport.

Factors which can influence the sucessful transport of live freshwater fish are discussed, including condition of fish, container design, density, temperature, dissolved oxygen and carbon dioxide, and the use of saline solutions. Capture and transport methods should be aimed at minimizing integument damage. Fish crowding should be minimized, as rapid reaeration becomes critical, and excretory products may build up to toxic levels. Methods to regulate oxygen and carbon dioxide levels are presented. The use of dilute saline solutions to reduce loss of body water and salts and prevent fungal infections is also reviewed. (See also W80-02126) (Deal-EIS)
W80-02125

CRITICAL FACTORS IN THE TRANSPORT OF LIVE FRESHWATER FISH--II. STATE OF FEEDING AND AMMONIA EXCRETION,
Ministry of Agriculture, Fisheries and Food, London (England). Salmon and Freshwater Fisheries Lab.
D. J. Solomon, and A. L. Taylor.
Fisheries Management, Vol 10, No 2, p 81-85, 1979. 4 Fig, 6 Ref.

Descriptors: *Fish physiology, *Oxygen requirements, *Ammonia, *Agriculture, Perches, Fish management, Mortality, Toxicity, Fish diets, Feeding rates, Shrimp, Animal metabolism, *Fish transport.

Two serious problems in the transport of live freshwater fish are oxygen depletion and ammonia toxicity. Studies were performed on perch (Perca fluviatilis) to quantify these two parameters. It was noted that following feeding there is a marked increase in oxygen consumption probably due to the metabolic processes of growth and tissue replacement. It was not possible to determine the relationship of meal size to this change. In studies of ammonia excretion it was found that post-feeding excretion rates varied directly with meal size. In reference to live transport it was recommended that a period of starvation precede moving in order to minimize risks. (See also W80-02125) (Deal-EIS)
W80-02126

REINVESTIGATION OF THE TOXINS FROM THE BLUE-GREEN ALGA, APHANIZOMENON FLOS-AQUAE, BY A HIGH PERFORMANCE CHROMATOGRAPHIC METHOD,
Rhode Island Univ., Kingston. Dept. of Pharmacognosy.
M. Alam, Y. Shimizu, M. Ikawa, and J. Sasner, Jr.
Journal of Environmental Science Health, Vol A13, No 7, p 493-499, 1978. 2 Fig, 9 Ref. OWRT A-047-NH(2), 14-34-0001-7062.

Descriptors: *Toxins, *Algal toxins, *Chromatography, *Cyanophyta, *Shellfish, Aquatic life, *Saxitoxin, *Toxin detection, *Blue-Green algal glooms, *Red tides, New Hampshire, Lakes.

Toxic red tides due to blue-green alga Aphanizomenon flos-aquae are becoming common occurrences in the lakes of New Hampshire. The toxins from Aphanizomenon flos-aquae were purified by a high performance chromatographic method. One of the toxins was identified as saxitoxin; the other three gave reactions indicating their structural similarity to toxins isolated from Gonyaulax tamarensis.
W80-02159

WATER QUALITY ASSESSMENT OF THE TRIBUTARIES TO THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions of the Illinois State Academy of Sciences, Vol 71, No 3, p 260-272, November 1978. 1 Fig, 11 Tab, 7 Ref.

Descriptors: *Water quality, *Tributaries, *Streams, *Sampling, *Illinois, Lakes, Rivers, Pollutants, Temperature, Water temperature, Dissolved oxygen, Turbidity, Hydrogen ion concentration, Alkalinity, Hardness(Water), Nitrogen, Silica, Iron, Chlorides, Sulfates, Phosphorus, Water pollution sources, Path of pollutants, Pollutant identification, *Fox Chain of Lakes(IL).

An assessment of the water quality characteristics of the Fox River and four other tributaries to the Fox Chain of Lakes, based on a year long weekly sampling schedule, was presented. The stream waters are typical of the midwestern region, high in alkalinity and hardness. The dissolved oxygen concentrations were below 5 mg/l in the major tributaries. Nippersink Creek showed the highest rate of nitrate transported, 4.54 kg/ha/yr, followed by 3.92 kg/ha/yr for the Fox River at Route 173. The unit nitrate loads transported by all of these streams are considerably less than the average nitrate contribution of 23.53 kg/ha/yr observed for the Kaskaskia River upstream of Shelbyville. The phosphorus concentrations in the Fox River, Sequoit Creek, and Squaw Creek exceeded the Illinois Pollution Control Board's recommended limit all of the time. The total phosphorus transported by the tributaries to the Fox Chain of Lakes appears to be several orders of magnitude higher when compared with the total phosphorus transported by rivers in central Illinois. (Sims-ISWS)
W80-02168

NUTRIENT BUDGET AND ITS CRITICAL EVALUATION FOR THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5B.
W80-02169

A SIMPLIFIED STATISTICAL SEQUENCE APPLIED TO ROUTINE WATER QUALITY ANALYSIS: A CASE HISTORY,
International Minerals and Chemical Corp., Detroit, MI.
For primary bibliographic entry see Field 5B.
W80-02172

PREDICTING LEVEL OF DISSOLVED REACTIVE PHOSPHATE IN THE LAFAYETTE RIVER, VIRGINIA, FROM INFORMATION ON TIDE, WIND, TEMPERATURE, AND SEWAGE DISCHARGE,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5B.
W80-02178

OPTICAL MEASUREMENTS OF CRUDE OIL SAMPLES UNDER SIMULATED CONDITIONS,
National Environmental Satellite Service, Washington, DC.
W. A. Hovis, and J. S. Knoll.
NOAA Technical Memorandum NESS 105, October 1979. 16 p, 15 Fig, 6 Ref.

Descriptors: *Crude oil, *Oil pollution, *Water pollution, Spectroscopy, Remote sensing, Pollutant identification, Optical measurement, Weathering.

Spectrographic measurements of the solar reflectance from 0.2 to 2.4 micro meter and radiometric equivalent blackbody temperature measurements from 10.5 to 12.5 micro meter were made on 10 different types of crude oil under simulated aging conditions of sun, wind, and salt water wave action at the USEPA OHMSETT site in Leonardo, N.J. Four days of exposure produced little change in the reflectance from 0.2 to 2.4 micro meter, but oil-water temperature differences of up to 18C were recorded in the 10.5 to 12.5 micro meter region. Large changes in viscosity were also measured. (NOAA)
W80-02210

MECHANISMS OF COPPER TOLERANCE IN THE MARINE FOULING ALGA ECTOCARPUS SILICULOSUS- EVIDENCE FOR AN EXCLUSION MECHANISM,
Manchester Polytechnic Lancashire (England). Dept. of Biological Sciences.
A. Hall, A. H. Fielding, and M. Butler.
Marine Biology, Vol 54, p 195-199, 5 Tab, 18 Ref.

Descriptors: *Copper, *Antifouling materials, *Marine algae, Resistance, Toxicity, Metabolism, Membrane processes, Biological membranes, Growth rates, Fouling, Algicides, Muisance algae, Plant physiology, *Ectocarpus.

Copper-tolerant strains of the marine fouling alga Ectocarpus siliculosus, have been recorded. The mechanism of tolerance which may operate in a copper-tolerant strain were investigated by comparing the growth characteristics, copper content and extracellular organic production of tolerant and non-tolerant strains. Growth was measured by a wet-weight method. The copper content of dry-ashed cells was measured spectrophotometrically using tetraethyl-thiuram disulphide. Evidence suggests that an exclusion mechanism is operating in the tolerant strain under investigation. The extracellular material, the cell wall or an associated organisms make little or no contribution to this exclusion. Membrane and intracellular changes are believed to account for the tolerance in this train of E. siliculosus. (Deal-EIS)
W80-02213

CHLORINATED PARAFFINS-AN ENVIRONMENTAL HAZARD,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
O. Svanberg, and E. Linden.
Ambio, Vol 8, No 5, p 206-209, 1979. 2 Fig, 18 Ref.

Descriptors: *Organic compounds, *Toxicity, *Hazards, Path of pollutants, Chemical wastes, Chemical properties, Chemical analysis, Analytical techniques, Chemical degradation, Absorption, Fish physiology, Persistence, Rainbow trout, Fish diets, Mode of action, Biodegradation, *Chlorinated paraffins, *Paraffins, *Tissue analysis, *Bioaccumulation.

Chlorinated paraffins form a large group of products, used mainly as secondary plasticizers, oil additives and flame retardants. World production amounts to about 230,000 metric tons per year. Lack of specific sensitive analytical methods has made it impossible to explore the spread of these persistent chemicals in the environment. The extent of their degradation and the degradation products formed under natural conditions are not known. Uptake from water and accumulation in fish is dependent on the chemical structure of the product. Their acute toxicity to mammals is considered low but very little is known concerning their chronic toxicity. Symptoms of toxic effects in exposed fish, however, have been observed. (Deal-EIS)
W80-02214

MERCURY IN WATER AND FISH FROM THE SAO VINCENTE ESTUARY NEAR SANTOS, BRAZIL,
Instituto de Pesca, Santos (Brazil). Coordenadoria de Pesquisa de Recursos Naturais,
J. R. Ferreira, H. Bergman Filho, J. F. Krug, N. A. Menezes, and P. E. Hansen.
Ambio, Vol 8, No 5, p 210-213, 1979. 3 Fig, 2 Tab, 28 Ref.

Descriptors: *Mercury, *Chemical wastes, *Water quality standards, Path of pollutants, Heavy metals, Estuarine environment, Water chemistry, Chemical analysis, Industrial wastes, Absorption, Fish physiology, Radiochemical analysis, Water pollution sources, Trophic level, Mullets, *Tissue analysis, *Bioaccumulation.

Total mercury was determined in water and edible fish from the Sao Vicente estuary using substoichiometric radioisotope dilution analysis. The water was found to conain 0.01-10 microg Hg/l with average values of 2.14, 1.80, and 1.66 microg/l at three sampling sites situated 30-35 km downstream from a large industrial region. These figures indicate gross mercury pollution. The fish were found to contain from 3 to 860 microg hg/kg in muscle tissue; the large majority were well below tolerance limits for human consumption (500 ug/kg). A future increase in the mercury content of the fish is indicated. (Deal-EIS)
W80-02215

RESPONSES TO SALINITY IN LARVAE FROM THREE LOCAL POPULATIONS OF THE FRESHWATER SHRIMP, MACROBRACHIUM NIPPONENSE,
Tokyo Univ. of Fisheries (Japan). Fisheries Resources Research Lab.
Y. Ogasawara, S. Koshio, and Y. Taki.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 8, p 937-943, 1979. 1979. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Salinity, *Adaptation, *Shrimp, Growth stages, Growth rates, Salt tolerance, Habitats, Larval growth stage, Animal populations, Animal physiology, Animal metabolism, Toxicity, Mortality, Lakes, *Zoeae.

Responses to variations in salinity were examined in larvae of the freshwater plaemonid shrimp Macrobrachium nipponense derived from females collected in Lake Kasumigaura, Lake Biwa, and the Shimanto River. Zoeas from kasumigaura females adjusted most successfully to seawater dilutions of 30-50% while those from Shimanto females to 40-70% sea water. Zoeas from Biwa females showed rather inconsistent survival patterns, but their response to salinity was on the whole not very different from that of Kasumigaura zoeas. The duration of the free-swimming larval stage was much linger in Shimanto zoeas than in Kasumigaura and Biwa zoeas. In each local sample the duration tended to be shorter in optimum salinity levels and longer in unfavorable salinities. The carapace length of 1st-stage zoeas was 0.30-0.38 mm for Kasumigaura zoeas and 0.23-0.25 mm for Shimanto zoeas. These results suggest that the duration of the free-swimming larval stage, as well as the number of zoea stages, decreases as the shrimp undergoes adaptation to fresh water, and that M. nipponese inhabiting Lakes Kasumigaura and Biwa is in a more advanced position than that occurring in the Shimanto River with regard to the degree of adaptation to fresh water. (Deal-EIS)
W80-02216

REQUIREMENT OF CARP FOR DIETARY ZINC (IN JAPANESE),
Tokyo Univ. of Fisheries (Japan). Lab. of Fish Nutrition.
C. Ogino, and G-Y. Yang.
Bulletin of Japanese Society of Scientific Fisheries, Vol 45, No 8, p 967-969, 1979. 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Nutrient requirements, *Zinc, *Carp, Trace elements, Heavy metals, Fish physiology, Animal metabolism, Fish diets, Fish diseases, Water chemistry, Growth rates, Mortality, Toxicity, *Iron, *Copper, Chemical analysis, *Tissue analysis, *Bioaccumulation.

Carp weighing 1.9 g and 1.5 g on the average were fed purified diets containing different amounts of zinc for 12 and 16 weeks, respectively. The rearing water contained zinc at a level of 10 microg per l. Dietary zinc levels were found to affect not only the appetite, growth rate, and mortality of the carp, but also the levels of zinc, iron, and copper in the tissues. The fish fed the diet containing 1 ppm zinc suffered from erosion of the skin and the fins. The requirement of carp for dietary zinc was proved to be 15 to 30 ppm of the dry diet under the present experimental conditions. (Deal-EIS)
W80-02217

ISOLATION AND IDENTIFICATION OF A CONJUGATED-PCP EXCRETED IN THE URINE OF GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
K. Kobayashi, and N. Nakamura.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 45, No 8, p 1001-1003, 1979. 4 Fig, 9 Ref.

Descriptors: *Pollutant identification, *Fish physiology, *Path of pollutants, Animal metabolism, Organic compounds, Chemical analysis, Chromatography, Chemical properties, Biochemistry, Sulfates, Potassium, *Goldfish, *Carassius, *Pentachlorophenol.

The renal excretion of PCP absorbed by goldfish, Carassius auratus, exposed to PCP and the isolation and identification of a PCP-conjugate found in the urine have been studied. Approximately 90% of the PCP excreted in the urine was found in a conjugate-form. The conjugate was isolated by treating the urine with an activated charcoal column, followed by elution with an acetone-ammonia mixture, and finally by passing the concentrated eluate through a Sephadex G-10 column. The isolated conjugate was identified as pentachlorophenylsulfate by the elution pattern on the Sephadex column, by thin-layer chromatography, and finally by determination of the molar ratio of PCP to SO4. No other conjugates, such as the glucuronide, were detected in the urine. (Deal-EIS)
W80-02218

AN ECOLOGICAL AND ENVIRONMENTAL SURVEY OF THE HUMIC MAN-MADE LAKES IN FINLAND,
Helsinki, Univ. (Finland). Dept. of Environmental Conservation.
H. Vogt.
Aqua Fennica, Vol 8, p 12-24, 1978. 9 Fig, 3 Tab, 16 Ref.

Descriptors: *Lakes, *Reservoirs, Lake sediments, *Artificial lakes, Peat, Fish population, Fish management, Finland, Lake stages, Lake ecosystems, Surface areas, Water quality, Acidic water, Humus, Humus lakes, *Primary productivity, Zooplankton, Bottom fauna, Environmental effects.

In western and northern Finland there are 18 polyhumic man-made lakes that are strongly regulated. This survey deals with the ecological properties of these highly peculiar aquatic ecosystems. Three different phases can be distinguished in the succession development of man-made lakes: beginning, erosion and stabilization. It will take tens, even hundreds of years before these reservoirs reach the stage of stabilization. The study also deals with the effects of these man-made lakes on nature and on human environment as well as with the possibilities of restoring the lakes. To restore the lakes to productivity special attention should be paid to the management and care of the scenery and the fish populations as well as to improving the quality of the water in the reservoirs. (Katz-EIS)
W80-02219

HEAVY METALS IN THE SEA-SKATER HALOBATES ROBUSTUS FROM THE GALAPAGOS ISLANDS: CONCENTRATIONS IN NATURE AND UPTAKE EXPERIMENTS, WITH SPECIAL REFERENCE TO CADMIUM,
Scripps Institution of Oceanography, La Jolla, CA.
L. Cheng, P. J. Franco, and M. Schulz-Baldes.
Marine Biology, Vol 54, p 201-206, 1979. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Cadmium, *Absorption, *Insects, Heavy metals, *Zinc, *Copper, *Lead, *Chromium, Growth stages, Zooplankton, Path of pollutants, Chemical analysis, Animal metabolism, *Bioaccumulation, *Tissue analysis, *Halobates.

Samples of Halobates robustus from the Galapagos Islands were analysed by optical emission spectrometry. The levels (in microg g-1 dry weight) of Zn (134), Cu (155), Pb (<1), Cd (7), and Cr (3) were not significantly different among insects of different sexes or developmental stages. The low natural levels of Cd in H. robustus from the relatively unpolluted envirnoment of the Galapagos Islands are compared to the high concentrations of Cd in Halobates spp. from relatively polluted regions. Since the measured levels of Cd in their natural zooplankton food rarely exceed 10 microg./g, and very little of the Cd is found in the soft tissues, the high Cd concentrations (100 to 200 microg./g) in some sea-skater species have evidently been derived by drinking from the surface micro-layer of the seawater. (Deal-EIS).
W80-02221

SOME STUDIES ON THE HEPATIC MICROSOMAL ENZYME ACTIVITIES AND STEROID HORMONE LEVELS IN CARP, CYPRINUS CARPIO EXPOSED FOR SIX MONTHS,
London Univ. (England).
K. Sivarajah, C. S. Franklin, and W. P. Williams.
Journal of Fish Biology, Vol 15, p 249-253, 1979. 1 Fig, 3 Tab, 10 Ref.

Descriptors: *Enzymes, *Toxicity, *Polychlorinated biphenyls, Fish physiology, Animal metabolism, Biochemistry, Proteins, Water chemistry, Organic compounds, Gas chromatography, Pollutant identification, Mode of action, *Blood chemistry, *Tissue analysis, *Hormones.

A short-term study from October 1975 to April 1976 was carried out by keeping 10 carp in two separate cages (five in each) at each of the three sites, namely, Wraysbury Reservoir, Ryemeads Sewage Lagoon and Deephams Sewage Lagoon (Fish unit). Fish were not artificially fed. Blood samples were collected at monthly intervals. Activities of the following hepatic microsomal enzymes, aminopyrine demethylase, p-nitro-reductase, UDP-glucuronyl transferase and 1-leucyl-B-naphthylamide splitting enzymes were measured; cytochrome P450 and microsomal protein contents were also estimated. The levels of androgens, oestrogens and corticoid hormones were measured in the circulating blood at monthly intervals. Results indicated that there was (1) no significant increase in the activities of all the enzymes measured except for an increase in cytochrome P450 in the fish kept at Deephams Sewage treatment works, (2) no significant increase in microsomal protein content at the three sites and (3) no significant changes in the levels of plasma androgens, and corticoids of the circulating blood. (Deal) (EIS).
W80-02225

EFFECTS OF TEMPERATURE AND STOCKING DENSITY ON FOOD CONSUMPTION AND GROWTH OF GRASS CARP CTENOPHARYNGODON IDELLA, VAL.,
Arkansas Univ., Fayetteville. Dept. of Zoology.
R. V. Kilambi, and W. R. Robison.
Journal of Fish Biology, Vol 15, p 337-342, 1979. 6 Tab, 21 Ref.

Descriptors: *Water temperature, *Growth rates, *Carp, Fish physiology, Fish management, Feeding rates, Fish populations, Fish farming, Productivity, Length, Size, Weight, Energy conversion, *Population density.

Grass carp were raised in 227 liter indoor tanks at 12.8, 18.3, 23.9 and 29.4C temperatures, each experimental condition received five fish. Five grass carp were also raised in a 1135 l tank maintained at 29.4C representing low stocking density (29.4 C-L). Food consumption, food conversion, and growth of carp were not different among the 18.3, 23.9, and 29.4C experimental conditions with identical stocking density. The least growth and food consumption were noted for the fish at the 12.8C temperature. The fish at the low stocking density had the best growth and maximum food consumption. (Deal-EIS).
W80-02226

RELATIONSHIP OF ENVIRONMENTAL PCO2 TO SELECTED BLOOD PARAMETERS OF ONCORHYNCHUS KISUTCH (WALBAUM),
Rhode Island Univ., Kingston. Dept. of Animal Science.
J. K. Bubien, and T. L. Meade.
Journal of Fish Biology, Vol 15, p 343-347, 1979. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Carbon dioxide, *Water chemistry, *Toxicity, *Fish physiology, Animal metabolism, Sockeye salmon, Bicarbonates, Chlorides, Hydrogen ion concentration, Chemical analysis, Gases, *Tissue analysis, *Blood chemistry.

Blood samples from sub-adult coho salmon were correlated with environmental conditions. Carbon dioxide tensions, pH and bicarbonate levels were determined in the blood for fish acclimated to environmental pC02 levels of 2.49 and 2.74 mmHg. Fish were removed from the high pC02 environment and placed in one with a low pC02. Their blood pH and pC02 were monitored during the course of acclimation. After 27 days of acclimation to a low pC02 environment, a group of fish was sampled and compared to a group of fish acclimated to a high pC02 environment. It was found that pC02 in the environment affects the rate of diffusion of carbon dioxide from the blood to the water. Under the environmental conditions prescribed in these experiments no significant change in bicarbonate was noticed. It is postulated that a bicarbonate chloride exchange is not a major pathway for the removal of carbon dioxide from the blood of 0. kisutch. (Deal-EIS).
W80-02228

PHYSICAL AND CHEMICAL ASPECTS OF THE DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE AQUATIC ENVIRONMENT,
URS Co., Seattle, Wa.
S. P. Pavlou, and R. N. Dexter.
In: Aquatic Toxicology, American Society for Testing & Materials, STP667, L. L. Marking & R. A. Kimerle, Eds., p 195-211, 1979. 6 Fig, 6 Tab, 27 Ref.

Descriptors: *Polychlorinated biphenyls, *Aroclors, Water quality, *Chemical analysis, Sediments, *Zooplankton, Puget Sound, Estuaries, Path of pollution, Water pollution, Chemical properties, Reactions(Chemical), Chemical distribution, Methodology, Annual changes, Suspended phases.

The distribution of polychlorinated biphenyl (PCB) compounds in Puget Sound is discussed in terms of the physical and chemical processes that influence their flow throughout the estuary. These data were used to examine the accumulation of PCBs in suspended phases and in lower trophic level biota. At the low PCB levels detected in this region, the data suggest that accumulation is predominantly governed by an equilibrium-partitioning mechanism. Support for the applicability of partitioning constants is presented, together with a discussion of their utility in describing the general distribution of PCBs in the aquatic environment. (KATZ-EIS).

W80-02229

STUDY OF THE EFFECTS OF MINING AND MILLING OPERATIONS ON HIGH MOUNTAIN STREAMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
J. P. Goettl, Jr., and P. H. Davies.
In: Water Pollution Studies. Job Progress Report, Federal Aid Project F-33-R-13, p 1-5, 1978. 2 Tab.

Descriptors: *Metals, *Zinc, *Cadmium, *Colorado, Williams Fork River, *Mine drainage, Mine wastes, Mineral industry, Water pollution effects, Water quality, Mining, Rio Grande River, High mountain streams, Brook trout, Freshwater fish.

Heavy metal concentrations in the Williams Fork River below the Henderson Project do not appear to have been altered by operation of the mill. Cadmium continues to appear as a contaminant above the mine and mill site. The Rio Grande River below the mining district of Creede had approximately the same level of zinc (75 microg/liter) as observed during high water periods the past 2 years. (Katz-EIS).
W80-02250

STUDY OF THE EFFECTS OF METALIC IONS ON FISH AND AQUATIC ORGANISMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
J. P. Goettl, Jr., and P. H. Davies.
In: Water Pollution Studies. Job Progress Report, Federal Aid Project, F-33-R-13, p 6-40, 1978. 13 Tab.

Descriptors: *Zinc, *Copper, *Lead, *Cadmium, *Silver, *Manganese, *Selenium, Metals, Toxicity, Rainbow trout, Freshwater fish, Toxicity, Mortality standards, Water quality, Colorado, Bioassay, Laboratory tests.

On the basis of laboratory experiments it was determined that only poor fisheries will be found in water with more than 400 mg/l suspended solids. Fish fed 10 micrograms of selenium/gram food had 21% mortality. The liver is the most suitable organ for detecting prior long term exposure to cadmium. Warm water species may be as sensitive to zinc as rainbow trout. Fathead minnows, speckled dace and mottled sculpins are as sensitive to silver as rainbow trout. 1.0 mg/liter for manganese is recommended as a standard for Colorado. There is a lack of synergistic or additive effects for solutions of zinc, copper, lead, cadmium and silver. (Katz-EIS).
W80-02251

MERCURY IN SOUTHERN NEW ENGLAND COASTAL RAINS,
Connecticut Univ., Groton. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W80-02326

INFLUENCE OF WELL WATER QUALITY VARIABILITY ON SAMPLING DECISIONS AND MONITORING,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 5B.
W80-02356

THE RELATIONSHIP BETWEEN VERTEBRAL NUMBER AND WATER TEMPERATURE IN COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
K. Brander.
Journal du Conseil, Inst. Explor. Mer. Vol 38, No 3, p 286-292, 1978. 3 Fig, 2 Tab, 1 App, 15 Ref.

Descriptors: *Water temperature, *Toxicity, *Animal growth, Marine fish, Growth stages, Fish populations, Spawning, Age, Atlantic Ocean, Mode of action, *Cod, *Tissue analysis, *Teratogens, *Vertebrae.

An inverse relationship between water temperature during early development and mean vertebral number (VS, includes urostyle) is established for cod populations throughout the North Atlantic, but the extent to which differences in VS are inherited is unknown. The VS of different year classes of cod from the North Sea shows some dependence on water temperature and the year class should therefore be taken into account, where possible, when seeking evidence of separation between stocks. Values of VS for populations around the British Isles are plotted on the temperature-VS relationship. Two areas for which the vertebral numbers seem anomalous are the English Channel and the northeast Irish Sea and these anomalies are discussed. (Deal-EIS)
W80-02368

THE INFLUENCE OF TEMPERATURE CHANGE ON NUMBER OF ANAL FIN RAYS DEVELOPING IN FUNDULUS MAJALIS (WALBAUM),
North Carolina Univ., Morehead City. Inst. of Marine Sciences.
W. E. Fahy.
Journal du Conseil Int. Explor. Mer, Vol 38, No 3, p 280-285, 1978. 1 Fig, 3 Tab, 20 Ref.

Descriptors: *Water temperature, *Toxicity, *Animal growth, Growth rates, Growth stages, Killfishes, Embryonic growth stage, Thermal stress, Habitats, Mortality, Hatching, *Teratogens, *Tissue analysis, *Vertebrae.

In each of two experiments embryos of this cyprinodont fish were reared continuously in four fluctuating temperature regimes, 13-17, 18-22, 23-27, and 28-32C to determine response of presumptive anal fin-ray tissue to temperature change. Because of excessive mortality among embryos in the 13-17C temperature regime, only one transfer lot from this regime could be used. In both experiments a positive linear relationship was indicated between mean anal fin-ray count and temperature, more anal rays developed on the average with increasing temperatures. In one experiment the transfer of embryos from one of the cooler regimes to the warmest at a three-to-six-somite stage of development produced a mean anal fin-ray count similar to that of embryos reared continuously in the warmest regime, but significantly different from the mean of those reared continuously in the original cool regime. The transfer of embryos from one of the cooler regimes to the warmest at a nine-to-twelve-somite stage produced a mean anal fin-ray count similar to that of embryos reared continuously in the cooler regime, but significantly different from the mean of those reared continuously in the warmest regime. In regard to morphological time of fixation of anal fin-ray tissue in this species temperature can influence the number of anal fin rays at the three-to-six-somite stage of development; although the nine-to-twelve-somite stage showed no response to temperature influence, later stages may be sensitive. (Deal-EIS)
W80-02369

GOBIUS NIGER AS INDICATOR OF HGTOT MEAN CONCENTRATION IN THE MARINE ENVIRONMENT,
Parco Marino di Miramare, Trieste (Italy).
M. Bussani, and M. Princi.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkee, p 671-672, 1979. 1 Fig, 7 Ref.

Descriptors: *Mercury, *Bioindicators, *Water chemistry, Heavy metals, Aquatic environment, Chemical analysis, Crustaceans, Gastropods, Mollusks, Insects, Phaeophyta, Rhodophyta, Chlorophyta, *Gobius, *Tissue analysis, *Polychaetes.

156 measurements of total Hg on 86 marine organisms, both animal and plant, were performed during the years 1975 to 1977 in the Gulf of Trieste. A graphic solution of data revealed that the mean concentration of total Hg in 35 specimens of Gobius niger is closely correlated with that of all other organisms examined. It might therefore be advisable to chose Gobius niger as indicator of mercury contamination of the marine environment, also in view of its wide geographical distribution. (Deal-EIS)
W80-02372

UTILIZATION OF CONCENTRATING ORGANISMS (MYTILUS GALLOPROVINCIALIS LMK) FOR THE SURVEY AND CONTROL OF MARINE POLLUTION,
Trieste Univ. (Italy). Inst. of Hygiene.
L. Majori, G. Nedocian, G. B. Mononutti, and F. Daris.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L' Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 599-604, 1979. 3 Fig, 28 Ref.

Descriptors: *Mussels, *Bioindicators, *Heavy metals, Mercury, Lead, Water chemistry, Chemical analysis, Amalutical techniques, Water quality, Monitoring, Research equipment, Methodology, *Mytilus, *Tissue analysis, *Bioaccumulation.

The feasibility of using the mussel (Mytilus galloprovincialis) as a monitoring organism for low level marine pollution is investigated. Mytilus species are ubiquitous organisms, making them a desirable indicator. Several experiments were summarized in which it was found that Mytilus accumulated metals from water proportional to the water concentration. When transfered to relatively unpolluted waters Mytilus depurated metals from its tissues. It was concluded that Mytilus is an acceptable organism for monitoring marine metal pollution. (Deal-EIS)
W80-02374

SHORT- AND LONG-TERM EFFECTS OF SOME POLLUTANTS ON BENTHIC COPEPODS OF GENUS TISBE (COPEPODA, HARPACTICOIDA),
Consiglio Nazionale delle Richerche, Venice (Italy). Inst. of Marine Biology.
L. Dalla Venezia.
In: IVes journees d'etudes sur les pollutions marine en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkee, p 439-443, 1979. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Oil, *Linear alkylate sulfonates, *Toxicity, *Copepods, Salinity, Detergents, Mortality, Growth stages, Lethal limit, Larval growth stage, Organic compounds, Biological communities, Chemical properties, *Dispersants, *Corexit.

Using copepods of the genus Tisbe, a series of experiments were conducted on the effects of an oil-oil dispersant-seawater mixture, a domestic detergent containing LAS, and LAS interactions with low salinity. In the oil-dispersant experiment, concetrations greater than 5 mg/l increased mortality above that of controls. As for the LAS experiments, a marked variability in sensitivity was noted between three different Tisbe species. It was concluded that low-level LAS pollution would eliminate the least resistant species. Finally, it was determined that lower salinities enhance the toxic effects of LAS. (Deal-EIS)
W80-02380

CHLORIDE INHIBITION OF NITRITE-INDUCED METHEMOGLOBINEMIA IN CHANNEL CATFISH (ICTALURUS PUNCTATUS),
Memphis State Univ., Ecological Research Center.
J. R. Tomasso, B. A. Simco, and K. B. Davis.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 1141-1144, 1979. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Fish physiology, *Toxicity, *Nitrite, Channel catfish, chlorides, Inhibition, Water chemistry, Mode of action, Chemical properties, Bicarbonates, Nitrification, *Blood chemistry, *Tissue analysis.

Exposure of channel catfish fingerlings for 24 h to 1.0, 2.5, and 5.0 mg/L nitrite (pH = 7; hardness -

40 mg/L; temperature = 22-25C) produced methemoglobin levels of 20.7 - 59.8 and 77.4, respectively. However, methemoglobin levels were not elevated when fish were simultaneously exposed to 1.0, 2.5, and 5.0 mg/L nitrite and 25, 50, and 100 mg/L sodium chloride, respectively. Acclimation to sodium chloride for 24 h before exposure to nitrite did not enhance the inhibitory action of sodium chloride. Fish exposed to 5 mg/L nitrite for 5 h developed 42.5 3.8% methemoglobin. When transferred to water containing 5 mg/L nitrite and 250 mg/L sodium chloride, methemoglobin levels returned to normal within 24 h. An ionic ratio of 16 Cl- to 1 NO2 - is capable of complete suppression of nitrite-induced methemoglobin formation. (Deal-EIS)
W80-02384

INTERACTIONS OF CHLORINE, TEMPERATURE CHANGE (DELTA T), AND EXPOSURE TIME ON SURVIVAL OF STRIPED BASS (MORONE SAXATILIS) EGGS AND PROPLARVAE,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
D. T. Burton, L. W. Hall, S. L. Margrey, and R. D. Small.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1108-1113, 1979. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Striped bass, *Toxicity, *Cholorine, *Water temperature, Fish eggs, Larval growth stage, Mortality, Entrainment, Powerplants, Chlorination, Mathematical models, Statistical analysis, Heated water.

Effects of total residual chlorine (TRC), change in temperature (delta T), and exposure time on eggs, TRC and delta T and exposure time were all found to be important in causing mortality of prolarvae. The study shows that in an evaluation of the potential effects of chlorinated power plant cooling waters to striped bass ichthyoplankton, a systematic study must be made of the interactions of TRC, delta T, and exposure time. (Deal-EIS)
W80-02385

FACTORS INFLUENCING DISTRIBUTION OF MUSSELS IN THE BLANCO RIVER OF CENTRAL TEXAS,
Southwest Texas State Univ., San Marcos. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W80-02387

SPHAERIIDAE AS INDICATORS OF TROPHIC LAKE STAGES,
Smithsonian Institution, Washington, DC.
For primary bibliographic entry see Field 5C.
W80-02388

STUDIES ON THE TOXICITY OF RIVERS -I TOXICITY OF THE URAKAMI RIVER IN NAGASAKI CITY (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fisheries.
H. Kitamura, T. Kariya, and M. Sato.
Bulletin of the Faculty of Fisheries Nagasaki University, No 47, p 15-20, 1979. 4 Fig, 4 Tab, 8 Ref. (England Summary).

Descriptors: *Toxicity, *Organic wastes, *Chemical oxygen demand, Water quality, Chemical analysis, Seasonal, Water temperature, Flow rates, Water quality standards, Chemical wastes, Productivity, Fish populations, *Japan, Urakami River.

This paper describes the relationship between toxicity and pollution of rivers. The freeze concentration and water quality of the Urakami River in Nagasaki were studied by carrying out toxicity tests. In this research, COD was used as a index for organic pollution. Using the freeze concentration toxicity tests, we were able to determine the toxicity to be 1800% when the solution was 100%. Water samles were collected in May, August, December of 1977 and in February of 1978 at 10 stations along the Urakami River, and the results were as follows: In autumn and winter, water pollution grew worse in comparison with spring and summer. The difference in water temperatures and the volume of the water flow were determined to be the cause. The change in the toxicity was similar to the water quality. The level of toxicity in autumn and winter was considered to be harmful to fish. It was established that there is a close correlation between toxicity and COD, therefore, it is advantagous to restrict the amount of organic polluants being dumped into rivers in order to safeguard the life, quality and productivity of the fish existing in the river. (Deal-EIS)
W80-02389

ACCUMULATION OF COPPER IN CERTAIN BIVALVES OF VELLAR ESTUARY, PORTO NOVO, S. INDIA IN NATURAL AND EXPERIMENTAL CONDITIONS,
Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Study.
A. K. Kumaraguru, and K. Ramamoorthi.
Estuarine and Coastal Marine Science, Vol 9, p 467-475, 1979. 5 Fig, 6 Tab, 17 Ref.

Descriptors: *Copper, *Absorption, *Commercial shellfish, Chemical analysis, Animal metabolism, Path of pollutants, Water chemistry, Estuarine environment, Oysters, Metals, Spectrophotometry, *Tissue analysis, *Bioaccumulation.

The copper content of three spcies of bivalves of commercial food value, Anadara granosa, Meretrix casta and Crassostrea madrasensis, inhabiting Vellar estuary was determined. Their soft body tissues had copper levels ranging from 7.56 to 11.08 ppm in A. granosa 10.85 to 11.73 ppm M. casta and 15.21 to 18.70 ppm in C. madrasensis on the basis of dry weight. Analysis of different organs (gills, mantle, hepatopancreas, foot and adductor muscles) showed that the gills and mantle contain more copper, suggesting the binding capacity of the mucous protein. These bivalves were experimentally subjected to different copper concentrations (0.02, 0.04, 0.06 and 0.08 ppm) in synthetic sea water media (25 ppt salinity and pH 8.0 + or - 0.1) kept in the laboratory for 96 h, and later analysed for copper both for entire soft body level and for different organs. An increase in copper concentration of the medium increased the accumulation. (Deal-EIS)
W80-02390

GASTROPODS AS INDICATORS OF TROPHIC LAKE STAGES,
Smithsonian Institution, Washington, DC.
A. H. Clarke.
The Nautilus, Vol 94, No 4, p 138-142, 1979. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Gastropods, *Bioindicators, *Trophic level, Lakes, Habitats, Mesotrophy, Oligotrophy, Eutrophication, Niches, Adaptation, Water quality, Spatial distribution, Mulluscs, *Pulmonates.

Field data associated with the 91 species and subspecies of boreal and arctic North American freshwater gastropods were analyzed. Most species and sub-spcies are eurytopic, but a few are entirely, or nealy, restricted to lakes of particular trophic levels. These are: Valvata sincera sincera for oligotrophic lakes, Fossaria decampi and Stagnicola catascopium for oligotrophic and mesotrophic lakes, and Amnicola limosa, Lymnaea stagnalis jugularis, and Planorbula armigera for eutrophic lakes. Physa integra is frequently associated with mesotrophic lakes but also occurs in other habitats. The indicator species are illustrated and briefly described. (Deal-EIS)
W80-02393

AVOIDANCE OF SEAWATER DILUTIONS OF KRAFT PULP MILL EFFLUENT BY SEAWATER ACCLIMATED PINK SALMON FRY,
Department of Fisheries and Environment, Vancouver (British Columbia). Habitat Protection Div.
G. L. Greer, and G. J. Kosakoski.
Fisheries and Marine Service Technical Report No 831, 1978. 11 p 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Pulp wastes, *Toxicity, *Fish behavior, *Pink salmon, Fry, Growth stages, Chemical wasts, Pulp and paper industry, Bioassay, Salinity, Sea water, Fish physiology.

Seawater acclimated pink salmon fry (Oncorhynchus gorbuscha), were used to measure avoidance of bleached kraft pulp mill effluent (BKME) diluted in sea water. BKME with a 96 h LC50 of 75-80% full strength was avoided at concentrations ranging from 0.8-15.5% full strenght effluent but the avoidance was largely a response to lower salinity of the test water caused by addition of non-saline BKME. A change in behavioural strategy when avoiding seawater dilutions of BKME compared to avoidance of similar dilutions of fresh water in sea water indicated BKME produced some additional effect on the response to lower salinities. (Deal-EIS)
W80-02395

MOLT-RELATED SENSITIVITY OF DAPHNIA PULEX IN TOXICITY TESTING,
Waterloo Univ. (Ontario).
D. R. Lee, and A. L. Buikema, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 1129-1133, 1979. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Daphnia, *Chromium, *Toxicity, *Growth stages, Bioassay, Mortality, Animal physiology, Mode of action, Analytical techniques, Bioindicators, Embryonic growth stage, *Molting.

Continuous and short-term exposures of Daphnia pulex to 0.56 mg Cr/L showed that these animals undergo cyclic changes in susceptibility. Short-term exposure (2h) followed by transfer to clean water for 22 h resulted in significantly higher mortality for individuals that molted during exposure. Continuous exposure to chromate resulted in significantly shorter mean survival times for animals that had molted <4th before being placed in chromate solution. Because laboratory cultures can be synchronized with respect to molting, the effects of cyclic sensitivity can bias bioassay results. By examining the animals at the beginning of the test, the degree of synchrony can be determined and appropriate steps taken. (Deal-EIS)
W80-02396

TEMPERATURE PREFERENCE OF SEVERAL SPECIES OF SALMO AND SALVELINUS AND SOME OF THEIR HYBRIDS,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
R. H. Peterson, A. M. Sutterlin, and J. L. Metcalfe.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1137-1140, 1979. 3 Tab, 13 Ref.

Descriptors: *Water temperature, *Fry, *Salmonids, Atlantic salmon, Brook trout, Rainbow trout, Lake trout, Growth stages, Fish genetics, Adaptation, Habitats, Thermoclines, *Arctic char.

Temperature preference of newly feeding fry of two species of Salmo, three species of Salvelinus, and seven hybrids were determined in a horizontal gradient. Fry of species in the genus Salmo and intergeneric hybrids with female parent in Salmo selected significantly higher temperatures (13.0 - 15.0C) than did fry of species and hybrids of the genus Salvelinus (9.0-11.5C). No significant differences were obtained among spcies and hybrids within either of the two groups described above. Preferred temperatures of fingerlings (after 3 mo of feeding) of two species and two hybrids within Salvelinus were determined in a vertical temperature gradient. Brook trout preferred 17.5C, and lake trout 10.8C. The two hybrids (brook trout X lake trout and lake trout X brook trout) preferred intermediate temperatures (14.7 and 14.4C). Rainbow trout fingerlings selected 14.7C. (Deal EIS)
W80-02397

GROWTH AND MORTALITY OF THE BLUE MUSSEL (MYTILUS EDULIS) IN RELATION TO ENVIRONMENTAL INDEXING,
Fisheries and Marine Service, Dartmouth (Nova

Scotia). Bedford Inst. of Oceanography.
K. R. Freeman, and L. M. Dickie.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1238-1249, 1979. 5 Fig, 6 Tab, 17 Ref.

Descriptors: *Bioindicators, *Mussels, *Growth rates, *Mortality, Methodology, Productivity, Water quality, Analytical techniques, Size, Seasonal, Genetics, Animal metabolism, Animal physiology, Statistical analysis, Mathematical models, Monitoring.

Comparative production estimates of selected species may provide indices of environmental quality, but so far there is little information on the extent to which production responses are mediated by genotypes. This study used a single source stock of blue mussels to explore differences between two bays. Test animals were held in suspension for 20 mo and growth and mortality observations of size-groups and of identified individuals were made at biweekly intervals. Average growth rates differed slightly between bays but mortality differences were marked and were the principle determinants of net production differences between the bays. Observed growth rates differed markedly between individuals but showed a striking consistency within individuals, indicative of genetic influence on this parameter. Because both mortality and growth interact with body size and season, it is clear that the estimated production levels and differences between bays would be influenced by the mixture of genotypes. We conclude that growth and mortality measures of M. edulis could provide sensitive environmental indices, but growth types in the test stock would need to be standardized. (Deal-EIS)
W80-02399

5B. Sources Of Pollution

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. LOWER COOK INLET INTERIM SYNTHESIS REPORT,
Science Applications, Inc., Boulder, CO.
For primary bibliographic entry see Field 5A.
W80-02053

EXISTING DISTRIBUTION AND CONCENTRATION OF POTENTIAL CONTAMINANTS ASSOCIATED WITH PETROLEUM DEVELOPMENT,
Science Applications Inc., Boulder, CO.
K. W. Fucik.
In: Environmental Assessment of the Alaskan Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 13-23 July 1979. 7 Fig, 6 Tab, NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Baseline studies, *Water pollution sources, *Water quality, Oil pollution, Seepage, Resources development, Metals, Alaska, *Outer continental shelf, Cook Inlet(AK), Petroleum development, Natural seepage.

The Alaskan marine environment is essentially pristine with regards to petroleum contamination. Hydrocarbons in Lower Cook Inlet are primarily of biogenic origin although some evidence exists for the presence of petroleum hydrocarbons at low levels. Kachemak Bay is an area of potential accumulation of spilled hydrocarbons. Organic carbon levels tend to be high in the sediments of this area, probably because of the hydrographic regime of the bay which restricts the exchange of water and materials with Lower Cook Inlet. Concentrations of petroleum-derived hydrocarbons are highest in the Inlet above the Forelands, indicating a source of petroleum in this area possibly a producing oil field located in this part of the Inlet. Additional petroleum may be entering Lower Cook Inlet from alleged seeps in Kamishak Bay and from coal outcrops and urban inputs in Kachemak Bay. Levels of biogenic hydrocarbons indicate a high biological activity in Kachemak Bay. At the present time, it is probably safe to assume that Lower Cook Inlet is a relatively clean area with respect to the levels of metals contaminants. (See also W80-02053) (Sinha-OEIS)
W80-02054

CONTAMINANTS AND ENVIRONMENTAL DISTURBANCES THAT MAY ACCOMPANY PETROLEUM EXPLORATION AND DEVELOPMENT,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
P. R. Becker.
In: Environmental Assessment of the Alaskan Continestal Shelf, Lower Cook Inlet Interim Synthesis Report, p 27-47 July 1979. 11 Fig, 4 Tab. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Environmental effects, *Water pollution sources, Oil pollution, Baseline studies, Water pollution, Alaska, Oil spills, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK), Oil tankers.

Oil and gas production has occurred in the upper portion of Cook Inlet (above the Forelands) for about the last ten years, and onshore development has occurred just below the Forelands at Nikiski and Drift River. Information resulting from Cook Inlet's history of OCS development and applied engineering operations can provide more accurate projections of the effects of future OCS development in Lower Cook Inlet. Potential sources of hydrocarbons and associated contaminants are the off-shore platforms, pipelines, shore facilities including tanker terminals, tankers and chemicals that might be employed in the cleanup if an oil spill occurred. Considering the history of oil spills in other geographical areas and the locations of the leased blocks in Lower Cook Inlet, it is probable that the most damaging effect of platforms would come from large-volume acute spills from fires or blow-outs. It is believed that low-volume chronic released from formation waters and accidental small-volume spills would be dispersed fairly rapidly by the strong currents in the central lower Inlet. An important potential result of construction or expansion of onshore facilities is permanent habitat destruction through filling of subtidal areas and maintenance dredging. This could be catastrophic to biological populations both locally and regionally. A potential result of petroleum exploitation in Lower Cook Inlet is an increase in tanker traffic. (See also W80-02053) (Sinha-OEIS)
W80-02055

GEOLOGICAL HAZARDS TO PETROLEUM EXPLORATION AND DEVELOPMENT IN LOWER COOK INLET,
Science Applications, Inc., Boulder, CO.
R. E. Peterson.
In: Environmental Assessment of the Alaskan Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 51-70, July 1979. 16 Fig, 4 Tab. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Hazards, *Environmental effects, *Water pollution sources, Oil pollution, Earthquakes, Volcanoes, Alaska, *Outer Continental Shelf, Cook Inlet(AK), Petroleum development.

The potential geological hazards to petroleum industry development in Lower Cook Inlet are earthquake seismicity, tsunamis, volcanic eruptions, and the migration of sand-sized sediment along the seafloor. Through no active faults have been positively identified on the seafloor of the Inlet, shallow faulting is occurring as demonstrated by the distribution and frequency of shallow earthquakes. A substantial earthquake record exists for the Lower Cook Inlet region. The risk of damage due to ground rupture and ground shaking will increase in direct proportion to the increase in offshore structures, pipelines, and onshore facilities, i.e., damage will be proportional to industrial development in this area of very intense seismic activity. Augustine Island is an active volcano of the explosive eruption type. Its most recent eruption in 1976 generated violent explosions with large ash clouds, pyroclastic ash flows with nuees ardentes, and lava flows. hazards to industrial facilities from this volcano include large debris falls, corrosive rains, noxious gas clouds, and seismic seawaves. The distance to which a nuee ardente may travel offshore during a violent eruption is unknown. (See also W80-02053) (Sinha-OEIS)
W80-02056

TRANSPORT AND ALTERATION OF CONTAMINANT DISCHARGES,
Science Applications, Inc., Boulder CO.
E. J. C. Sobey.
In: Environmental Assessment of the Alaska Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 73-101, July 1979. 26 Fig. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Transport, *Oil spills, Baseline studies, Environmental effects, Water pollution, Circulation, Alaska, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK).

Limited results obtained from oil spill trajectory models suggest that buoyant material (floating oil) released in central Lower Cook will either accumulate along the western side of the inlet or be transported out of the inlet via Shelikof Strait. The deep circulation is too poorly known to use in predicting trajectories for non-buoyant pollutants. Preliminary results from experiments conducted to determine the accommodation capacity of suspended matter in Cook Inlet indicate that the capacity increases with increasing initial oil concentration and with decreasing temperature. Aggregates of oil and suspended matter tend to be spherical and larger than naturally-occurring particles. The size distribution of suspended matter does not change during the formation of oil/suspended matter aggregates, although the median size increases. Oil/suspended matter aggregates could settle at higher rates than naturally-occurring suspended matter in Lower Cook Inlet. (see also W80-02053) (Sinha-OEIS)
W80-02057

A SYNTHESIS OF ENVIRONMENTAL INFORMATION CONCERNING POTENTIAL OCS OIL AND GAS DEVELOPMENT IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
P. R. Becker.
In: Environmental Assessment of the Alaskan Countinental Shelf, Lower Cook Inlet Interim Synthesis Report, p 201-220, July 1979. 11 Fig, 5 Tab, NOAA-OCSEAP-03-7-022-35213.

Descriptors: *Environmental effects, *Resources Development, *Oil pollution, *Baseline studies, Water pollution sources, Water pollution effects, Ecosystems, Aquatic life, Hazards, Alaska, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK).

This section of the Interim Synthesis Report summarizes the information from the previous chapters on potential effects of OCS oil and gas exploration. The major topics covered are OCS development in Cook Inlet, present levels of oil contaminants, major hazards to OCS development, important species and habitats in Lower Cook Inlet and the probably effect on these habitats and species from OCS development. Potential sources of thermogenic hydrocarbons in Cook Inlet include natural oil seeps and coal outcrops, discharges from tankers and other vessels, waste discharges from urban areas, and offshore oil and gas operations. The concentration of thermogenic hydrocarbons in Lower Cook Inlet is very low and is similar to concentrations measured in other Alaskan waters. (See also W80-02053) (Sinha-OEIS)
W80-02059

SEWAGE CONTAMINATION IN THE NEW YORK BIGHT. COPROSTANOL AS AN INDICATOR,
National Oceanic and Atmospheric Administrarion, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
P. G. Hatcher, and P. A. McGillivary.
Environmental Science & Technology, Vol 13, No

10, p 1225-1229, October 1979. 4 Fig, 1 Tab, 22 Ref.

Descriptors: *Sediments, *Water pollution effects, *Sewage disposal, *Water pollution sources, Environmental effects, Domestic wastes, *Outer Continental Shelf, *New York Bight, Ocean dumping, Coprostanol, Anthropogenic components.

Sediments of the New York Bight are analyzed for coprostanol, a fecal steriod, to determine the degree of sewage contamination. Coprostanol, when reported as a percentage of total steriods (% coprostanol), can be quantitatively related to the amount of sewage-derived organic matter. Furthermore, coprostanol is quite persistent in anoxic silts of the Bight and, thus, can be used to delineate historical contamination in these silts. Based on the sediments analyzed, the New York Bight is shown to be highly contaminated with sewage (most likely ocean-dumped sewage sludge), especially in the topographically low areas near the dump site, where black silts have been known to accumulate. (Sinha-OEIS)
W80-02065

OCEANIC DIFFUSION OF A SEVERE ACCIDENTIAL RADIONUCLIDE RELEASE FROM A SUBSEA NUCLEAR POWER PLANT,
Offshore Power Systems, Jacksonville, FL.
S. M. Lainoff, and W. Nachbar.
Energy the International Journal, Vol 2, No 2, p 179-188, June 1977. 1 Fig, 6 Tab, 10 Ref.

Descriptors: *Nuclea powerplants, *Diffusion, *Radioactivity, California, Resources development, Water pollution control, Hazards, Sites, Environmental effects, *Outer Continental Shelf, *Subsea powerplants, Radionuclide release.

Seabed siting of nuclear power plants could reduce significantly the safety problem posed by the severest accident, core melt followed by containment breach, in which a considerable portion of the radionuclide inventory is rapidly released to the environment. At 80 fathoms depth, in addition to a possible sizeable reduction of accident probabilities, the accident consequences to human life are likely to be greatly reduced because the most deadly components of the radioactive cloud from a land-based site will be dissolved for the seabed site. The present paper deals specifically with the oceanic diffusion of dissolved radionuclides following a severe accident (the specifications for the reference accident PWR-2 of WASH-1400 are taken) at a site chosen off the coast of San Diego, California. (Sinha-OEIS)
W80-02067

ENVIRONMENTAL IMPACT ASSESSMENT FOR OTEC-1,
TRW Defense and Space Systems Group, Redondo Beach, CA.
L. Sinay-Friedman.
In: 'Ocean Thermal Energy for the 80's,' Preprints Volume II, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE CONF-790631/2, p 5C-2/1 - 5C-2/6, 1979. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Resources development, Baseline studies, Water quality, Water pollution sources, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC), Environmental impact, Biological impact.

Operation of a one megawatt electric (Mwe) set of OTEC heat exchangers aboard the OTEC-1 Early Ocean Test Platform, approximately 39 kilometers (km) northwest of Kawaihae, Hawaii will begin in April 1980 and continue for three and one-half years. In accordance with the National Environmental Policy Act (NEPA) of 1969, governmental activities must consider environmental impacts resulting from the project by preparing an Environmental Impact Assessment (EIA). This paper presents the latest results of the OTEC-1 Environmental Impact Assessment Study. The key environmental issues considered applicable to OTEC-1 which were assessed during the study relate to: (1) organism entrainment; (2) organism impingement; (3) ocean water mixing; (4) platform attraction; (5) chlorine releases; (6) ammonia leakage to the sea; (7) oil spills; (8) atmospheric pollution; (9) endangered species; and (10) socioeconomics. Major concerns have focused on the biological impacts. The OTEC-1 tests involve no electrical power generation, and negligible extraction of heat from the ocean. Nearfield effects of OTEC-1 will be localized and negligible in view of the broad distribution of pelagic organisms. Farfield effects could reach nearshore populations whose habitats may be more restricted, although this is not expected. (Sinha-OEIS)
W80-02073

OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
J. D. Ditmars, and R. A. Paddock.
In: Ocean Thermal Energy for the 80's, Preprints Volume II. 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE Conf-790631/2, p 6A-3/1 - 6A-3/8, 1979. 21 Ref.

Descriptors: *Energy conversion, *Resources development, *Environmental effects, Water quality, Baseline studies, Effluents, Climates, Gulf of Mexico, Models, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC), Heat exchange, Thermal resources.

Assessment of Ocean Thermal Energy Conversion (OTEC) environmental impacts and resource utilization requires an understanding of the physical processes underlying the interactions between an OTEC plant or plants and the ocean. This paper presents an overview of the U.S. Department of Energy program for the development and application of analyses and models for the prediction of the physical aspects of OTEC impacts. Prodictive tools are necessary to address problems at different site areas, scales of OTEC deployment, and time horizons. The effects of intake/discharge designs and of ambient ocean conditions on recirculation and near-field effluent plume behavior have been investigated by means of physical models. Further study of the intake flow fields may be necessary to make estimates of intake impingement and entrainment effects. Mathematical analysis of intermediate-field mixing of plant effluents has shown that effluent plumes may have vertical dimensions on the order of meters and lateral dimensions on the order of kilometers. Models of oceanic regional and island coastal circulation are required to investigate far-field effects on the scale of tens of kilometers. Basin-wide resource renewal and physical environmental effects are being studied by means of a numerical model of the Gulf of Mexico with detailed vertical resolution. Concerns regarding climatic impacts presently are focused on atmospheric CO_2 loading and modification of air-sea heat exchange processes due to OTEC operation. (Sinha - OEIS)
W80-02074

EFFECT OF CRUDE OIL AND DETERGENT 'SOLO' ON THE ACTIVITY OF SOME HYDROLASES IN HEMOLYMPH OF CRAB RHITHROPANOPEUS HARRISI,
Medical Academy, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02079

PHYSIOLOGICAL AND BEHAVIOURAL CHARACTERIZATION OF THE ACTION OF CHLORFENVINPHOS ON FISH LEBISTES RETICULATUS PETERS,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
R. J. Wroblewski.
Polskie Archiwum Hydrobiologii, Vol 26, No 3, p 427-456, 1979. 18 Fig, 6 Tab, 75 Ref.

Descriptors: *Pesticide toxicity, *Fish behavior, *Bioassay, Respiration, Feeding rates, Growth rates, Mode of action, Monitoring, Juvenile growth stage, Fish physiology, Insecticides, Organophosphorus pesticides, *Chlorfenvinphos, Guppies.

Classical acute toxicity tests as well as behavioural and physiological tests were performed. On account of the low (2.7-1.4 mg/l) values of index LC 50-24 h, chlorfenvinphos can be considered highly toxic to juvenile guppies. Five syndromes of behavioural symptoms of the severity of poisoning were distinguished. During exposure to poison, the sequence of syndromes was the same, both upon prolongation of exposure time and upon an increase in concentration. When fish were transferred to pure water, the first three syndromes receded in opposite sequence, whereas the two syndromes of more severe poisoning proved to be irreversible. Physiological indices of poisoning (food consumption, growth and respiration) were determined in fish transferred to pure water. Changes in food consumption proved to be the best index of poisoning. The suitability of various tests for biomonitoring and evaluation of the toxicodynamic properties of pesticides was discussed. (Deal-EIS)
W80-02084

TOXICITY AND RETENTION OF DDT IN ADULT FROGS, RANA TEMPORARIA L.,
Kuopio Univ., (Finland).
M. N. E. Harri, J. Laitinen, and E-L. Valkama.
Environmental Pollution, Vol 13, p 45-55, 1979. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Frogs, *DDT, *Toxicity, Absorption, Mortality, Mode of action, Pesticide residues, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Path of pollutants, Carbon radioisotopes, Tracers, Animal metabolism, Enzymes, *Tissue analysis, *Bioaccumulation.

The acute LD50 value of DDT in adult summer frogs was only 7.6 mg/kg. The symptoms of poisoning caused by DDT point to nervous damage. The toxicity was further increased by starving. The retention of DDT was followed using (14C)-labelled DDT. It accumulated most in tissues containing fat. Thus the fat body and lever retained much of the DDT while only a very small amount was found in skeletal or heart muscle. In female frogs a large quantity of DDT is stored in the overy, its large size and high fat content possibly accounting for this phenomenon. Moderate amounts of DDT were found in kidneys and nervous tissue. In addition, an auto-radiographical study revealed considerable radioactivity in bones and spleen. Starved animals retained higher amounts of DDT in their tissues, with the exception of the fat body, than did the fed animals. DDT was found to disappear extremely slowly. Its disappearance was, however, enhanced by previous DDT treatment since DDT-treated animals retained much less of the test dose than did the untreated controls. It is thus possible that DDT induces the activity of drug-metabolising enzymes which may lead to increased biliary excretion of the drug. (Deal-EIS)
W80-02090

CADMIUM IN MYTILUS EDULIS FROM GERMAN COASTAL WATERS,
Institut fuer Meereskunde, Bremerhaven (Germany, F.R.).
H. Theede, I. Andersson, and W. Lehnberg.
Meeresforschung, Vol 27, No 3, p 147-155, 1979. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Cadmium, *Mussels, *Baseline studies, Heavy metals, Chemical analysis, Size, Benthic fauna, Spectrophotometry, Kiel, Animal meatbolism, Path of pollutants, Bottom sediments, Water chemistry, *Tissue analysis, *Mytilus, *Baltic Sea, *Bioaccumulation.

In numerous places on the German Baltic coast the cadmium content of the edible common mussel Mytilus edulis is higher than in individuals from the North Sea Coast. The highest cadmium content is found in mussels from the innermost part of the Kiel Fjord. Speciments from the outer parts of the Keil and Flensburg Fjord contain less cadmi-

um. Further, mussels from pier timbers have considerably lower cadmium concentrations than those from the neighbouring sediment. Within the size range of 0.05-0.5 g dry weight there is a tendency for the smaller specimens to have a higher cadmium concentration. In the mussels' organs the concentration decreases in the following order: digestive diverticula, kidney, gills, adductor muscle, mantle with gonads, foot. (Deal-EIS)
W80-02094

INFLUENCE OF THE MODE OF CONTAMINATION ON THE SUBSEQUENT ELIMINATION OF COBALT 60 BY A PHANEROGAME, A MOLLUSC, A CRUSTACEAN AND BY A FRESHWATER FISH (IN FRENCH),
Laboratoire de Biologie Marine, Nantes (France) Faculte des Sciences.
C. Amiard-Triquet.
Environmental Pollution, Vol 13, p 65-78, 1979. 4 Fig, 3 Tab, 32 Ref.

Descriptors: *Path of pollutants, *Aquatic plants, *Cobalt radioisotopes, Nuclear powerplants, Absorption, Radioactive wastes, Cobalt, Aquatic environment, Food webs, Metabolism, Carp, *Elodea.

60C enters the environment with radioactive wastes from nuclear power reactors and fuel reprocessing plants as well as a component of fallout from nuclear tests. A study of 60C in freshwater organisms has been carried out in order to compare the influence of different modes of uptake (immersion in contaminated water, ingestion of radioactive food, contamination by both food and water) upon the subsequent elimination. The loss of 60C by Canadian pondweed Elodea canadensis is monophasic. For animal species, this phenomenon is biphasic, independently of the mode of uptake. On the other hand, the biological half-life changes in relation to the vector of contamination. The same result is observed for the relative importance of the different compartments. This is easily explained because the mode of uptake determines the distribution of 60C in the organisms. The turnover of 60C in the organisms is slow and the physical half-life of this radionuclide is relatively important (Tp = 5.27 years). Thus, the possible consequences of the release of this pollutant on freshwater life must not be neglected. (Deal-EIS)
W80-02098

EFFECTS OF TOXIC AMOUNTS OF DIETARY ZINC ON THE GROWTH AND BODY COMPONENTS OF RAINBOW TROUT AT TWO LEVELS OF CALCIUM (IN JAPANESE).
Freshwater Fisheries Research Lab., Tokyo (Japan).
For primary bibliographic entry see Field 5A.
W80-02102

AN ASSESSMENT OF KNOWLEDGE CONCERNING THE FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5A.
W80-02107

THE EFFECT OF NAPHTHALENE ON SYNTHESIS OF PEPTIDE ANTIFREEZE IN THE BERING SEA SCULPIN, MYOXOCEPHALUS VERRUCOSUS,
Illinois Univ. at Urbana-Champaign. Dept. of Physiology and Biophysics.
For primary bibliographic entry see Field 5A.
W80-02108

PESTICIDES: THEIR IMPACT ON THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02109

COMPARATIVE METABOLISM OF PARATHION BY INTERTIDAL INVERTEBRATES,
California Univ., Davis. Dept. of Environmental Toxicology.
For primary bibliographic entry see Field 5A.
W80-02110

BIOACCUMULATION OF DDT AND PCB IN TISSUES OF MARINE FISHES,
Environmental Research Lab., Gulf Breeze, FL.
P. A. Butler, and R. L. Schutzmann.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials. STP 667, p 212-220, 1979. 7 Tab, 11 Ref.

Descriptors: *DDT, *Polychloride biphenyls, *Marine fish, Pesticide residues, Pesticide kinetics, Commercial fish, Chemical analysis, Path of pollutants, Fish physiology, Persistence, DDE, *Bioaccumulation, *Tissue analysis.

Fishes of commercial importance were monitored in New England coastal waters in 1974 to determine whether synthetic organic residues in the fish were large enough to affect the utilization of such fish as food by man or to interfere with their ability to reproduce. About 700 fish of 20 species were pooled in samples of five to ten, and the livers were analyzed. Several species, including the spiny dogfish, contained residue of dichlorodiphenyltrichloroethane (DDT) and its metabolites and of polychlorinated biphenyl (PCB) compounds in the 1 to 10 microg/g (ppm) range. More detailed studies of the dogfish in 1975 demonstrated the transfer of these compounds from the parent fish to the ovarian egg and the mature fetus. The proportions of the DDT metabolites found suggest that this pesticide had been accumulating in the 18 to 20 year period of maturation of the female and was passed on to the first brood of young. In contrast to the findings of other investigations, there was no fixed relationship in the relative magnitude of DDT and PCB residues when both compounds were present in a sample. (Deal-EIS)
W80-02112

TEST OF A MODEL FOR PREDICTING KEPONE ACCUMULATION IN SELECTED ESTUARINE SPECIES,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02113

CONSIDERATIONS IN ASSESSING THE POTENTIAL FOR, AND SIGNIFICANCE OF, BIOMAGNIFICATION OF CHEMICAL RESIDUES IN AQUATIC FOOD CHAINS,
EG and G Bionomics, Wareham, MA.
For primary bibliographic entry see Field 5A.
W80-02115

EFFECTS OF CALCIUM AND SEDIMENT CONCENTRATIONS ON THE RELEASE OF METALS AND NUTRIENTS FROM DREDGE SPOIL DISPERSIONS,
Corps of Engineers, Detroit, MI. Detroit District.
For primary bibliographic entry see Field 5A.
W80-02119

ECOLOGICAL KINETICS OF SILVER IN AN ALPINE LAKE ECOSYSTEM,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
R. A. Freeman.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials STP 667, p 342-358, 1979. 6 Fig, 6 Tab, 31 Ref.

Descriptors: *Seasonal, *Ecosystems, *Metals, Chemical properties, Chemical analysis, Path of pollutants, Climatology, Aquatic environment, Alpine, Fallout, Rocky Mountain region, *Silver, *Bioaccumulation.

The cycling characteristics of silver were studied in a small watershed and lake in the Colorado alpine region. The sources of silver for the watershed were atmospheric fallout and washout, groundwater percolation, and cloud seeding. Monthly synoptic samples of snow, stream and lake water, groundwater, soil, sediment, sediment interstitial water, aquatic plants, benthos, seston, and fish were analyzed for two years. The biological samples were subjected to acid digestion while ammonium pyrrolidine dithiocarbamate-methyl isobutyl ketone extractions were performed on the aqueous samples. Silver in the sediment was extracted by iodide complexation. The silver concentrations showed marked seasonal variations in all ecosystem components studied, and this implied a partially reversible mechanism of bioaccumulation. Variations in silver concentration in the ecosystem components were statistically correlated on the basis of their physical and biological interactions, and these correlations provide a framework for an annual silver cycle. A chain of effects initiated by terrestrial climatological events is hypothesized to be causal in the levels of silver which eventually appear in aquatic biota and environments. (Deal-EIS)
W80-02120

TRANSPORT AND TRANSFORMATIONS OF ANTHRACENE IN NATURAL WATERS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W80-02121

THE EFFECT OF PLANTS AND ANIMALS ON THE CHEMISTRY OF ESTUARINE SEDIMENTS,
Cape Town Univ. (South Africa). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02122

ORGANOCHLORINE CONTAMINANTS AND TRENDS IN REPRODUCTION IN GREAT LAKES HERRING GULLS, 1974-1978,
Department of Fisheries and Environment, Burlington (Ontario).
D. V. Weseloh, P. Mineau, and D. J. Hallett.
Transactions of the Forty-fourth North American Wildlife and Natural Resources Conference, p 543-557, 1979. K. Sabol, Ed. 2 Fig, 4 Tab, 37 Ref.

Descriptors: *Pesticide residues, *Gulls, *Bird eggs, *Great Lakes, Chlorinated hydrocarbon pesticides, DDT, Polychlorinated biphenyls, Dieldrin, DDE, Reproduction, Pesticide kinetics, Persistence, *Lake Ontario, *Lake Erie, *Lake Huron, *Lake Superior, Fecundity, Hatching, *Mirex, *HCB, *Tissue analysis.

Herring gull eggs were monitored for levels of the major organochlorine residues in two colonies from each of Lakes Ontario, Erie, Huron and Superior during 1974, 1975, 1977 and 1978. Colonies of Lake Ontario were the most contaminated followed by Lakes Huron and Superior with Lake Erie as the least contaminated. Since 1974 significant decreases were evident in levels of DDT, mirex and PCBs, at all colonies and most colonies showed similar decreases for dieldrin, DDE and HCB. One significant increase was noted for DDT for Granite Island (Lake Superior) between 1977 and 1978. Reproductive success of herring gulls was determined on all colonies in 1978 and on selected colonies prior to that. Reproductive success has shown a substantial improvement on Lakes Erie and Ontario. It was directly paralleled by a decline in the major organochlorine residues. Reproductive success on Lake Huron and Lake Superior has remained relatively high. Continued monitoring of residue levels and the reproductive success of herring gulls will serve to indicate trends in contamination by persistent toxicants and in the overall health of the Great Lakes ecosystem. Trends from 1974 to 1978 show a general improvement. (Deal-EIS)
W80-02123

THE EFFECT OF TILLAGE SYSTEMS ON PESTICIDES IN RUNOFF FROM SMALL WATERSHEDS,

Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W80-02147

PHYSIOLOGY OF SALINITY-DEPENDENT NAPHTHALENE TOXICITY IN FUNDULUS HETEROCLITUS,

Delaware Univ., Newark. Coll. of Marine Studies.
W. M. Levitan, and M. H. Taylor.
Journal of the Fisheries Research Board of Canada, Vol 36, No 6, p 615-620, 1979. 5 Fig, 22 Ref. OWRT A-043-DEL(2), 14-34-0001-9008.

Descriptors: *Fundulus heteroclitus, Mummichogs, *Salinity, Mortality, Toxicity, Naphthalene, Respiration, Metabolism, Bioassay, Estuaries, Fish Physiology, Environmental effects, Toxins, Osmotic imbalance, Laboratory tests, Organic compounds, Cortisol.

The influence of salinity on mortality in mummichogs, Fundulus heteroclitus, subjected to naphthalene and the physiological bases for the salinity-dependent mortalities were determined. Fish were acclimated to five salinities, 2, 8, 15, 23, and 33 ppth, and exposed to 6 and 4 mg naphthalene/L. At 4 mg/L, fish survival was greater at hypo- and near isoosmotic (15 ppth) salinities than at hyperosmotic salinities. At 6 mg/L, survival was generally greatest at 8 and 15 ppth and decreased at the salinity extremes. In fish exposed to 4 mg naphthalene/L, uptake was more rapid at the iso- and hyperosmotic salinities than at hypoosmotic salinities and osmotic imbalance occurred only at hyperosmotic salinities. Serum cortisol levels and oxygen consumption rates increased at all salinities upon exposure to 4 mg naphthalene/L. However, the most significant increases in oxygen consumption rates occurred at hyperosmotic salinities. Thus, the greater naphthalene uptake, osmotic imbalance, and metabolic stress occurring at hyperosmotic salinities may contribute to the increased mortality of naphthalene-exposed fish acclimated to hyperosmotic salinities. (D. Katz-EIS)
W80-02150

WATER QUALITY ASSESSMENT OF THE TRIBUTARIES TO THE FOX CHAIN OF LAKES,

Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5A.
W80-02168

NUTRIENT BUDGET AND ITS CRITICAL EVALUATION FOR THE FOX CHAIN OF LAKES,

Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions of the Illinois State Academy of Science, Vol 71, No 3, p 273-285, November 1978. 1 Fig, 5 Tab, 10 Ref.

Descriptors: *Water quality, *Nutrients, *Water pollution sources, *Sampling, *Illinois, Nitrogen, Phosphorus, Precipitation(Atmospheric), Septic tanks, Sewage, Effluents, Pollutants, Path of pollutants, Water pollution, Lakes, Rivers, *Fox Chain of Lakes(IL).

The Fox Chain of Lakes receives approximately 6370 kg/day of total nitrogen and 730 kg/day of phosphorus. Of the total phosphorus and total nitrogen, about 130 kg/day of phosphorus and 375 kg/day of nitrogen emanate from point sources of waste discharges. The Fox River transports about 70% of inorganic nitrogen, and together with Nippersink and Squaw Creeks contributes about 93% of the total inorganic nitrogen. Also, these three tributaries contribute 86% of the dissolved orthophosphorus. About 27% of total nitrogen and 37% of total phosphorus influx into the lake system are retained in the lakes. The impacts of septic tank systems and precipitation were found to be equal as far as total phosphorus is concerned. The net loading rates, considering only the readily available nitrogen and phosphorus retained in the lakes, were found to be 17.4 g/sq m/yr and 1.5 g/sq m/yr, respectively, for nitrogen and phosphorus. These loading rates, computed on the basis of lake surfaces, were several orders of magnitude in excess of rates for these nutrients which the lakes could absorb without showing the symptoms of eutrophication. It was estimated that phosphorus recycled from the sediments in deep water areas of the Fox Chain alone appears to be adequate for sustaining algal blooms for a long period of time. (Sims-ISWS)
W80-02169

A SIMPLIFIED STATISTICAL SEQUENCE APPLIED TO ROUTINE WATER QUALITY ANALYSIS: A CASE HISTORY,

International Minerals and Chemical Corp., Detroit, MI.
G. A. Alther.
Ground Water, Vol 17, No 6, p 556-561, November-December 1979. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Water pollution, *Water quality, *Path of pollutants, *Statistical analysis, Sewage, Effluents, Sewage effluents, Streams, Sampling, Data processing, Chemicals, Calcium, Magnesium, Sodium, Potassium, Chlorine, Nitrates, Dissolved oxygen, Hardness(Water), Statistics, Analytical techniques.

A sequence of simple statistical tests was used to interpret the data from a routine water sampling project for a stream that was contaminated with effluent from a sewage treatment plant. The contamination of this stream was apparent from the murky condition of the water and its pungent odor. The outlet of the sewage treatment plant enters the stream at its origin. The chemical variables analyzed were Ca, Mg, Na, K, Cl, nitrates, TDS, and hardness. Background data from other streams in this drainage basin and data from the stream under investigation were subjected to cluster analysis in order to classify the sampled area into geochemical provinces. The contaminated stream under investigation comprised one province, and the background streams constituted another province. A linear regression performed on the data showed a statistically significant decrease of several variables with increasing distance from the outlet of the sewage treatment plant. An abrupt decrease in concentration of iron some 450 m below the plant outlet implied the presence of two populations with different means, which was statistically verified with a trimmed t-test. Use of these simple tests greatly facilitated interpretation of the data. (Sims-ISWS)
W80-02172

GROUND-WATER POLLUTION BY TRANSFER OF OIL HYDROCARBONS,

Strasbourg Univ. (France). Inst. de Mecanique des Fluides.
J. J. Fried, P. Muntzer, and L. Zilliox.
Ground Water, Vol 17, No 6, p 586-594, November-December 1979. 6 Fig, 46 Ref.

Descriptors: *Water pollution, *Soil contamination, *Oil, *Organic compounds, Oil spills, Porous media, Pollutants, Path of pollutants, Soils, Laboratory tests, Mathematical models, Aquifers, Groundwater, Groundwater movement, Fluid mechanics, Oil hydrocarbons.

An important aspect of the pollution of a phreatic aquifer by hydrocarbons is the oil-water contact and transfer of soluble substances from the oil into the groundwater. A systematic study of this transfer of matter in a saturated porous medium (initial condition of contact when the impregnation body is submitted to fluctuations of the piezometric level) was performed with an experimental device made up of a porous matrix containing the oil phase, steady and crossed by a unidirectional flow of water. The transfer was very efficient; for all compounds which have been studied, the maximum possible concentration was reached after a distance of the order of 10 cm with specific flow rates greater than those generally encountered in a gravel-sand aquifer. The selective impoverishment of the oil product with time, due to differences in the solubility of various hydrocarbons, modified the dissolved phase composition. Downstream of an in-situ impregnation body, this phenomenon only appears after a constant concentration has been reached for a long time. A source model was thus obtained where the pollutant massic flow rate was proportional to the flow rate of the water which crosses the impregnation body. Such an initial condition has a fundamental effect on the determination of the contaminated aquifer domain, with the help of the dispersion scheme, with hydrocarbon concentrations evolving according to a general diffusion-convection law. (Sims-ISWS)
W80-02173

PREDICTING LEVEL OF DISSOLVED REACTIVE PHOSPHATE IN THE LAFAYETTE RIVER, VIRGINIA, FROM INFORMATION ON TIDE, WIND, TEMPERATURE, AND SEWAGE DISCHARGE,

Harbor Branch Foundation, Inc., Fort Pierce, FL.
J. R. Montgomery.
Water Resources Research, Vol 15, No 5, p 1207-1212, October 1979. 5 Fig, 1 Tab, 33 Ref, 1 Append.

Descriptors: *Water chemistry, *Phosphates, *Estuaries, *Virginia, Sampling, Data processing, Model studies, Mathematical models, Forecasting, Rivers, Tidal waters, Phosphorus compounds, Oxygen, Dissolved oxygen, Temperature, Water temperature, Salinity, Sediments, Sewage, Water pollution, Water pollution sources, *Lafayette River(VA).

The Lafayette River in Norfolk, Virginia, is a shallow, turbid, urban estuary, polluted with primary treated sewage. The river was sampled monthly from October 1970 to January 1972. Oxygen, temperature, and salinity values are vertically and laterally homogeneous in the Lafayette River. The mean values of dissolved reactive phosphate (DRP) in the Lafayette River for the winter (1970-1971 and 1972), ranged from 2.2 to 5.8 microgram-atoms per liter and for the summer of 1971, 7.6 microgram-atoms per liter. Multiple linear regression models were prepared to relate the daily changes in phosphate to tide stage, wind component, and rate of phosphate discharge (kg/hr) from the Lamberts Point sewage treatment plant. The equations for the August 1971 sample showed that the effect of the tide stage is 3 times as important in the determination of the levels of DRP as the rate of flow of DRP from the sewage effluent on the ebbing tide and is equally important as the rate of flow of DRP from the sewage effluent on the flooding tide. The daily variations in DRP are more noticeable in the summer because of the higher concentrations of phosphate in the Lafayette River during this season. The increase of phosphate on the ebb tide and the decrease on the flood tide over a daily cycle was attributed to a dilution of the waters of the Lafayette River by the water from Hampton Roads. The direct relation of water temperature to the concentration of DRP for the seasonal model was attributed to the increased biochemical activities of the micro-organisms in the sediment-water system. (Sims-ISWS)
W80-02178

ESTIMATING SOLUTE TRANSPORT IN STREAMS FROM GRAB SAMPLES,

Pennsylvania Univ., Philadelphia. Dept. of Landscape Architecture and Regional Planning.
A. H. Johnson.
Water Resources Research, Vol 15, No 5, p 1224-1228, October 1979. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Sampling, *Path of pollutants, *Phosphorus, Streamflow, Discharge(Water), Data processing, Analytical techniques, Regression analysis, Nutrients, Water pollution, Pollutants, On-site investigations, Water pollution sources, Grab samples.

Several combinations of weighting procedures and schedules of sample collection resulted in substantial differences in calculated P transport by Fall Creek, New York. Calculation of P flux using regressions of concentration on flow is the most satisfactory for grab sample studies where solute concentration is correlated with stream discharge because regressions account for solute export at

the highest flows better than other methods. Acceptable estimates of yearly solute flux in a stream can probably be obtained from samples collected weekly and representing all flow stages. (Sims-ISWS)
W80-02180

SHORT-TERM COVARIABILITY OF CHLOROPHYLL AND TEMPERATURE IN THE ST. LAWRENCE ESTUARY,
Laval Univ., Quebec. Dept. de Biologie.
For primary bibliographic entry see Field 2L.
W80-02184

MISSISSIPPI RIVER SHOALING: A DIAGNOSTIC STUDY,
Iowa Univ., Iowa City, Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2E.
W80-02186

EVIDENCE OF ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINELANDS,
Pennsylvania Univ., Philadelphia.
A. H. Johnson.
Science, Vol 206, No 4420, p 834-835, November 16, 1979. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Acid streams, *Natural streams, *Water pollution, *New Jersey, Hydrogen ion concentration, Headwaters, Data collections, Analysis, Water quality, Small watersheds, *Oyster Creek(NJ), *McDonalds Branch(NJ).

Seventeen years of stream pH data indicate a trend of acidification in two small streams, McDonalds Branch and Oyster Creek, in the New Jersey Pine Barrens which drain relatively undisturbed areas. The decline in pH has amounted to approximately 0.4 unit, with an estimated increase in H(+) concentration of about 50 microequivalents per liter. The data collected to date are consistent with the postulation of an atmospheric source for the increased H(+). (Humphreys-ISWS)
W80-02190

DISTRIBUTION, RESIDENCE TIME, AND FLUXES OF TETRACHLOROETHYLENE AND 1,4-DICHLOROBENZENE IN LAKE ZURICH, SWITZERLAND,
Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschut Zurich (Switzerland).
R. P. Schwarzenbach, E. Molnar-Kubica, W. Giger, and S. G. Wakeham.
Environmental Science and Technology, Vol 13, No 11, p 1367-1373, November 1979. 4 Fig, 3 Tab, 45 Ref.

Descriptors: *Lakes, *Water quality, *On-site investigations, *Water pollution, Distribution, Mass transfer, Water sampling, Testing procedures, Analytical techniques, Variability, Seasonal, Chemical analysis, Epilimnion, Hypolimnion, Flow, *Lake Zurich(Switzerland), Residence time, Tetrachloroethylent, 1,4-Dichlorobenzene.

A 1-year study of tetrachloroethylene and 1,4-dichlorobenzene in Lake Zuich, Switzerland, has been conducted. The seasonal distribution of the compounds, which are continuously introduced to the lake at different locations, reflects the circulation in the lake and is compatible with the assumption derived from laboratory studies that mass transfer to the atmosphere is the predominant elimination mechanism. A mass balance for 1,4-dichlorobenzene has been established for the central basin of the lake, and an average residence time of approximately 5 months has been found. By applying a simple steady-state model, an average annual mass transfer coefficient of 1 cm/h was obtained for the transport of 1,4-dichlorobenzene and tetrachloroethylene from the lake to the atmosphere. (Humphreys-ISWS)
W80-02193

UNSATURATED FLOW BENEATH TAILINGS IMPOUNDMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 2F.
W80-02195

STRESS AND CHRONIC EFFECTS OF UNTREATED AND TREATED BLEACHED KRAFT PULPMILL EFFLUENT ON THE BIOCHEMISTRY AND STAMINA OF JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH),
British Columbia Research Council, Vancouver. Div. of Applied Biology.
D. J. McLeay, and D. A. Brown.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1049-1059, 1979. 2 Fig, 3 Tab, 62 Ref.

Descriptors: *Sockeye salmon, *Toxicity, *Pulp wastes, Growth rates, Fish physiology, Animal metabolism, Biochemistry, Juvenile growth stage, Proteins, Fish behavior, Chemical analysis, Waste treatment, Chemical wastes, *Pulp and paper industry, Mode of action, Mortality, *Blood chemistry, Tissue analysis.

Growth of juvenile coho salmon fed a limiting ration (70% of satiation) in experimental stream channels was not altered significantly by prolonged exposure to untreated or laboratory-treated (fermented) bleached Kraft-pulpmill effluent (BKME), although mean weights for control fish were consistently lower than those for all effluent-exposed groups from 100 to 200 d. Body protein, fat, and moisture content were unaffected by treatment at 30, 90, and 200 d. Fish exposed to all strengths of untreated or treated BKME (i.e. untreated concentrations equivalent by volume to 0.05, 0.1, 0.2, 0.3, and 0.5 of the untreated effluent's 96-h LC50 value; and treated concentrations equivalent by volume to 0.2 and 1.0 LC50) showed significant decreases in serum albumin levels at 30 d, whereas these recovered to control values at 90 and 300 d. The serum electrolytes Na+, K+, and Ca++ were unaffected by treatment at 200 d and not measured for other exposures. Liver and muscle glycogen reserves were decreased significantly by continuous exposure of fish to untreated or treated BKME concentrations for 30 d. These values recovered to control levels at 90 d and were unaffected or depressed at 200 d. Based on the changes in intermediary metabolism for BKME-exposed fish at 30, 90, and 200 d, it was concluded that these fish remained in a state of chronic stress and did not acclimate to prolonged exposure to pulpmill effluent. Treatment of this waste reduced or removed its acute (lethal) toxicity but did not alter the biochemical effects caused by chronic exposure. (Deal-EIS)
W80-02211

MEASURING AND ESTIMATING THE BIOCONCENTRATION FACTOR OF CHEMICALS IN FISH,
Environmental Research Lab.-Duluth, MN.
G. D. Veith, D. L. DeFoe, and B. V. Bergstedt.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1040-1048, 1979. 3 Fig, 4 Tab, 23 Ref.

Descriptors: *Analytical techniques, *Path of pollutants, *Pollutant identification, Chemical analysis, Organic compounds, Minnows, Absorption, Chemical properties, Laboratory tests, Fish physiology, Animal metabolism, Aroclors, Rainbow trout, Sunfishes, Pesticide residues, *Bioconcentration, *Tissue analysis, *Bioaccumulation, *Hexachlorobenzene.

A method of estimating the bioconcentration factor of organic chemicals in fathead minnows (Pimephales promelas) is described. Water at 25C was intermittently dosed with the chemical at a nontoxic concentration in a flow-through aquarium. Thirty minnows are placed in the aquarium, and composite samples of five fish are removed for analysis after 2, 4, 8, 16, 24, and 32 d of exposure. The bioconcentration process is summarized by using the first-order uptake model, and the steady-state bioconcentration factor is calculated from the 32-d exposure. A structure-activity correlation between the bioconcentration factor (BCF) and the n-octanol/water partition coefficient (P) of individual chemicals is summarized by the equation log BCF = 0.85 log P - 0.70, which permits the estimation of the bioconcentration factor of chemicals to within 60% before laboratory testing. The facilities and resources for testing need be used only for those chemicals that are likely to result in substantial bioconcentration in organisms. The bioconcentration factors derived from tests of mixtures of chemicals are shown to be the same as those derived from tests with the chemicals individually. (Deal-EIS)
W80-02212

MECHANISMS OF COPPER TOLERANCE IN THE MARINE FOULING ALGA ECTOCARPUS SILICULOSUS- EVIDENCE FOR AN EXCLUSION MECHANISM,
Manchester Polytechnic Lancashire (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-02213

CHLORINATED PARAFFINS-AN ENVIRONMENTAL HAZARD,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W80-02214

MERCURY IN WATER AND FISH FROM THE SAO VINCENTE ESTUARY NEAR SANTOS, BRAZIL,
Instituto de Pesca, Santos (Brazil). Coordenadoria de Pesquisa de Recursos Naturais,
For primary bibliographic entry see Field 5A.
W80-02215

ISOLATION AND IDENTIFICATION OF A CONJUGATED-PCP EXCRETED IN THE URINE OF GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Lab. of Fisheries and Chemistry.
For primary bibliographic entry see Field 5A.
W80-02218

HEAVY METALS IN THE SEA-SKATER HALOBATES ROBUSTUS FROM THE GALAPAGOS ISLANDS: CONCENTRATIONS IN NATURE AND UPTAKE EXPERIMENTS, WITH SPECIAL REFERENCE TO CADMIUM,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 5A.
W80-02221

NIFURPIRINOL (FURANACE; P-7138) RELATED LESIONS ON CHANNEL CATFISH ICTALURUS PUNCTATUS (RAFINESQUE),
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
A. J. Mitchell, J. M. Grizzle, and J. A. Plumb.
Journal of Fish Diseases, Vol 1, p 115-121, 1978. 7 Fig, 13 Ref.

Descriptors: *Aquiculture, *Fish diseases, *Bioassay, *Toxicity, *Animal pathology, Fish physiology, Channel catfish, Ictalurus punctatus, Toxicant, Skin lesions, Nifurpirinol, Furanace P-7138, Fish chemotherapeutic, Muscle lesions, Gill lesions.

Skin lesions developed on channel catfish, Ictalurus punctatus, exposed to 0.5 mg/l Furanace for 4 or 14 days. Lesions developed 3 days after the 4-day exposure and on the eleventh day of the 14-day exposure. The lesions continued to develop after the fish were moved to untreated water. The lesions which began as dull areas of skin, sometimes resulted in erosion of skin and muscle which exposed the vertebrae. Bacteria were not isolated from the lesions except those with severely eroded muscle. The gills possessed lesions characteristic of a response to a toxic chemical agent. (Katz-EIS).
W80-02222

RELATIONSHIP OF ENVIRONMENTAL PCO2 TO SELECTED BLOOD PARAMETERS OF ONCORHYNCHUS KISUTCH (WALBAUM),
Rhode Island Univ., Kingston. Dept. of Animal Science.
For primary bibliographic entry see Field 5A.
W80-02228

PHYSICAL AND CHEMICAL ASPECTS OF THE DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN THE AQUATIC ENVIRONMENT,
URS Co., Seattle, Wa.
For primary bibliographic entry see Field 5A.
W80-02229

DISTRIBUTION OF NITRATE AND RELATED NITROGEN SPECIES IN THE UNSATURATED ZONE, REDLANDS AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-02233

WATER QUALITY IN THE PROPOSED PROSPERITY RESERVOIR AREA, CENTER CREEK BASIN, MISSOURI,
Geological Survey, Rolla, Mo. Water Resources Div.
For primary bibliographic entry see Field 4A.
W80-02234

TEST DATA FROM THE CHLORIDE-MONITOR WELL AT SUN CITY CENTER, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. C. Sinclair.
Geological Survey open-file report 78-1030, 1979. 20 p, 13 Fig, 7 Tab.

Descriptors: *Saline water-freshwater interfaces, *Water wells, *Test wells, *Monitoring, *Water quality, Chlorides, Water supply, Aquifer characteristics, Hydrogeology, Groundwater movement, Rock properties, Water analysis, Chemical analysis, Evaluation, *Sun City Center(Fla).

A test well drilled for Southwest Florida Water Management District at Sun City Center in Hillsborough County, will serve to monitor the interface between freshwater in the aquifer and the underlying chloride water. The sulfate content of the water in the aquifer at the well site exceeds 250 mg/L below a depth of about 700 feet. Wells for domestic and public supply in the area bottom at less than 500 feet and are separated from the sulfate water by about 100 feet of poorly-permeable limestone. The freshwater-chloride water interface is quite sharp and occurs at a depth of 1,410 feet. The chloride water is similar in composition to seawater but nearly twice as saline. (Woodard-USGS).
W80-02244

QUALITY OF SURFACE AND GROUND WATERS, YAKIMA INDIAN RESERVATION, WASHINGTON, 1973-74,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W80-02245

MERCURY IN SOUTHERN NEW ENGLAND COASTAL RAINS,
Connecticut Univ., Groton. Dept. of Geology and Geophysics.
T. R. Fogg, and W. F. Fitzgerald.
Journal of Geophysical Research, Vol 84, No C11, p 6987-6989, November 20, 1979. 2 Tab, 19 Ref. NSF GX33777.

Descriptors: *Mercury, *Rainfall, *Chemistry of precipitation, *New England, Sampling, Chemical analysis, Water chemistry, Pollutants, Pollutant identification, Path of pollutants, Precipitation(Atmospheric), Chemicals, Sodium, Coasts, Meteorology, Chemistry.

Mercury analyses were performed on 9 different rain samples collected from Connecticut and Cape Cod (Masssachusetts) coastal locations. Concentrations of Hg averaged 10 + or - 5 ng/l for 29 determinations. Total washout of Hg from the atmosphere was not observed, suggesting that the quantity of Hg in rain may depend on the simple solution of various volatile species of Hg according to Henry's law. Existing global models use concentrations of 30-80 ng/l and appear to overestimate the rainfall Hg flux to the ocean. (Sim-ISWS)
W80-02326

MIXING OF BUOYANT SURFACE JET OVER SLOPING BOTTOM,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
B. Safaie.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14954, p 357-373, November 1979. 13 Fig, 22 Ref, 3 Append.

Descriptors: *Jets, *Mixing, *Industrial wastes, *Beaches, Laboratory tests, Model studies, Mathematical models, Discharge(Water), Thermal pollution, Water pollution, Buoyancy, Dispersion, Shear, Coastal engineering, Environmental engineering, Hydraulics, Surface jets.

The mean characteristics of a buoyant surface jet discharged horizontally over sloping bottom was investigated through a set of systematic experiments. It was found that the mean characteristics of the buoyant surface jet do not vary monotonically with the source densimetric Froude number due to the formation of large-scale eddies and buoyant spread. An empirical relationship between normalized separation depth and source densimetric Froude number was presented, and a possible mechanism explaining the dynamics of the detachment point was suggested. A simple integral model was developed for the momentum-dominated region. The results of this model were used in conjunction with experimental results to show that the shape of similarity profile in the momentum-dominated region is a function of the bottom slope and discharge aspect ratio. (Sims-ISWS)
W80-02338

TWO-DIMENSIONAL BUOYANT JETS IN STRATIFIED FLUID,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
S. J. Wright, and R. B. Wallace.
Journal of the Hydraulics Division, Anerican Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 15003, p 1393-1406, November 1979. 4 Fig, 1 Tab, 8 Ref, 3 Append. NSF ENG78-05445.

Descriptors: *Jets, *Stratified flow, *Dispersion, *Sewage disposal, Oceans, Diffusion, Buoyancy, Stratification, Outfall sewers, laboratory tests, Hydraulic models, Model studies, Mathematical models, Equations, Coastal engineering, Hydraulics, Diffusers.

A two-dimensional byoyant jet discharged into a stratified fluid with no crossflow was considered. Two simple equations were developed which relate the maximum height of rise, Z sub m, to a stratification parameter and the jet-source flux of either momentum or buoyancy. Length scale analysis provided the form of the equations and determined the conditions when each equation applies. Coefficients, not provided by the length scale analysis, were estimated by integrating the integral equation of momentum from the origin to the point of zero mementum. Scale model tests verified the form of the equations for Z sub m and provided experimental values of the coefficients. (Sims-ISWS)
W80-02343

MULTIPLE JETS IN SHALLOW FLOWING RECEIVING WATERS,
Auburn Univ., AL. Dept. of Civil Engineering.
A. D. Parr, and W. W. Sayre.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings Paper 14991, p 1357-1374, November 1979. 13 Fig, 2 Tab, 18 Ref, 2 Append.

Descriptors: *Jets, *Rivers, *Thermal pollution, Heated water, Powerplants, Mixing, Diffusion, Shallow water, laboratory tests, Model studies, Hydraulic models, Flumes, Water pollution, Hydraulics, Diffusers, Submerged jets.

An experimental study of multiple submerged heated jets discharging into confined, shallow, flowing receiving waters was conducted. Empirical relationships describing jet spreading and center line reduction of excess temperature and excess velocity near the source were developed. Comparisons between laboratory and field measurements were made for some of these relationships. A definition based on the experimental results was developed to predict the location where a row of submerged jets merge to form a two-dimensional slot jet. The results of the study should be of particular value in predicting the extent of cross-sectional mixing zones for submerged multiport diffusers in rivers. (Sims-ISWS)
W80-02344

COMPARISON OF VARIOUS METHODS OF SAMPLING SOIL WATER FOR DETERMINING IONIC SALTS, SODIUM, AND CALCIUM CONTENT IN SOIL COLUMNS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W80-02349

INFLUENCE OF WELL WATER QUALITY VARIABILITY ON SAMPLING DECISIONS AND MONITORING,
Science and Education Administration, Fresno, CA. Water Management Research.
H. I. Nightingale, and W. C. Bianchi.
Water Resources Bulletin, Vol 15, No 5, p 1394-1407, October 1979. 8 Fig, 2 Tab, 16 Ref.

Descriptors: *Groundwater, *Water quality, *Sampling, *Monitoring, *California, Wells, Water wells, Water chemistry, Variability, Risks, Statistics, Mathematical models, On-site investigations, Water pollution, Pollutants, *San Joaquin Valley (CA), Sample size, Sampling decisions.

Local governmental agencies responsible for decision in groundwater quality management need not only data on groundwater quality, but they also must understand the relationship of accuracies and risks associated with this data as related to the number of wells to sample. In this report this problem was addressed by using the philosophical doctrines of probabilism and relativism with simple statistical procedures. This requires a reasonable estimate of the population variance in quality parameter for a given management-unit area, and also requires that the decision maker formulate constraints with an acceptable standard error of the sample mean and be willing to accept some level of probability of being wrong. This technique was illustrated using a 21-year data base of well water chemical data in a 653 sq km groundwater quality study area in the San Joaquin Valley of California. (Sims-ISWS)
W80-02356

THE IMPORTANCE OF SOIL IN EVALUATING POTENTIAL WASTE WATER DISPOSAL SITES IN THE MISSOURI OZARKS,
Missouri Univ., Columbia. School of Forestry, Wildlife and Fisheries.
For primary bibliographic entry see Field 2G.
W80-02357

A STUDY OF THE PERSISTENCE OF SOME WATER-QUALITY PARAMETERS (ETUDE DE LA PERSISTANCE DE QUELQUES PARAMETRES DE QUALITE DE L'EAU),
Institut National de la Recherche Scientifique, Ri-

mouski (Quebec).
For primary bibliographic entry see Field 7C.
W80-02359

GOBIUS NIGER AS INDICATOR OF HGTOT MEAN CONCENTRATION IN THE MARINE ENVIRONMENT,
Parco Marino di Miramare, Trieste (Italy).
For primary bibliographic entry see Field 5A.
W80-02372

UTILIZATION OF CONCENTRATING ORGANISMS (MYTILUS GALLOPROVINCIALIS LMK) FOR THE SURVEY AND CONTROL OF MARINE POLLUTION,
Trieste Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 5A.
W80-02374

FISH EGGS DIMENSIONS AND POLLUTION,
Athens Univ., (Greece). Dept. of Zoology.
A. Yannopoulos.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 461-463, 1979. 2 Fig, 1 Ref.

Descriptors: *Fish eggs, *Toxicity, *Nitrates, Nutrients, Size, Seasonal, Dimensions, Water temperature, Water pollution effects, Mode of action, Industrial wastes, Municipal wastes, *Sardina.

The most imprortant systematic characters of fish eggs, their dimensions, depend on various parameters, some already known, such as the period of the spawning season when egg deposition occurs, the age of the females, the temperature of the water and the different races of the same species. The present study gives evidence that heavy pollution, in the form of high concentrations of nitrates due to industrial and urban wastes, can affect the size of fish eggs, reducing them to below normal. It has not been defined if the presence of nitrates have a direct influence on the dimensions of fish eggs after their deposition or, what is more likely, an indirect one through the female ovaries. (Deal-EIS)
W80-02375

ON THE EFFECTS OF DDT ON ENZYME ACTIVITIES IN MUGIL CEPHALUS L.,
Institut za Oceanografiju i Ribarstvo, Split (Yugoslavia).
M. Tidor, and J. V. Bannister.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 445-447, 1979. 1 Tab.

Descriptors: *Enzymes, *Toxicity, *DDT, *Mullets, Inhibition, Animal metabolism, Fish physiology, Biochenmistry, Pesticide toxicity, Mode of action, Chemical analysis, Chlorinated hydrocarbon pesticides.

Some in vitro and in vivo observations on the DDT effects on activaties of enzymes from muscles and liver of Mugil cephalus L. were carried out. The in vitro tests showed a significant stimulating effect on lactate dehydrogenase from liver and fumarase from red muscles and liver. The white muscle lactate dehydrogenase showed reduced activity. The in vivo effects were quite different. Lactate dehydrogenase activity was inhibited in white and red muscle. An inhibitory effect was also found for succinate dehydrogenase and fumarase from all tissues. The cytochrome oxidase activity was extermely reduced. (Deal-EIS)
W80-02377

METALS IN THE MOLLUSCAN KIDNEY: A COMPARISON OF TWO CLOSELY RELATED BIVALVE SPECIES (ARGOPECTEN), USING X-RAY MICROANALYSIS AND ATOMIC ABSORPTION SPECTROSCOPY,
National Inst. of Environmental Health Science, Research Triangle Park, NC. Lab. of Environmental Toxicology.
N. G. Carmichael, K. S. Squibb, and B. A. Fowler.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 1149-1155, 1979. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Bioindicators, *Metals, *Molluska, Chemical analysis, Spectroscopy, Animal physiology, Animal metabolism, X-ray analysis, Path of pollutants, Calcium, Phosphorus, Manganese, Zinc, Cadmium, Copper, Chromium, Trace elements, *Scallop, *Argopecten, Kidney.

The kidney epithelial cells of Argopecten irradians contain concretions that occur within an apical vacuole in these cells and that have been analyzed in situ by energy dispersive X-ray microanalysis. Pellets of these concretions prepared from A. irradians and A. gibbus were compared by X-ray microanalysis and atomic absorption spectrophotometry; calcium and phosphorus were the major elements present in both species, but A. irradians contained higher amounts of magnesium and lower amounts of manganese and zinc than A. gibbus when expressed relative to calcium content. However, A. gibbus contained a smaller proportion of calcium by weight than A. irradians, and A. gibbus contained much higher levels of Cd, Cu, and Cr than A. irradians. The trace metal content of scallop kidney concretions may be a sensitive monitor of marine metal contamination provided that sufficient base line data are collected and individual, species, seasonal, and geographical variability are taken into account. (Deal-EIS)
W80-02383

ACCUMULATION OF COPPER IN CERTAIN BIVALVES OF VELLAR ESTUARY, PORTO NOVO, S. INDIA IN NATURAL AND EXPERIMENTAL CONDITIONS,
Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Study.
For primary bibliographic entry see Field 5A.
W80-02390

THE OCCURRENCE OF COPPER, IRON AND ZINC IN THE HARD SHELL CLAM, MERCENARIA MERCENARIA, AND SEDIMENTS OF SOUTHAMPTON WATER,
Centeral Electricity Generating Board, Southampton (England). Marine Biological Lab.
M. G. Romeril.
Estuarine and Coastal Marine Science, Vol 9, p 423-434, 1979. 6 Fig, 4 Tab, 12 Ref.

Descriptors: *Metals, *Clams, *Absorption, *Copper, *Iron, *Zinc, Animal metabolism, Path of pollutants, Seasonal, Bottom sediments, Powerplants, Water pollution sources, Age, England, Southamption water, *Tissue analysis, *Bioaccumulation, *Depuration.

The concentration of copper, iron and zinc has been measured in hard shell clams, Mercenaria mercenaria, collected from several localities in Southampton Water to provide the background data necessary for the accurate assessment of the significance of observed fluctuations. The studies reveal considerable seasonal, age and geographical fluctuations in tissue metal concentrations. All metal concentrations in clam tissue are lower at the seaward end of the estuary, but although sediment metal levels generally follow a similar trend, tissue and sediment values appear to correlate with each other only for iron. There appears little evidence of any significant effect on metal uptake which could be attributable to the operation of Marchwood Power Station. (Deal-EIS)
W80-02391

LEAD IN SPOTTED WOLFISH, ANARHICHAS MINOR, NEAR A ZINC-LEAD MINE IN GREENLAND,
Copenhagen Univ. (Denmark). Inst. for Petrology.
H. J. Bollingberg, and P. Johansen.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1023-1028, 1979. 4 Fig, 3 Tab, 11 Ref.

Descriptors: *Lead, *Absorption, *Fish physiology, Growth stages, Mine wastes, Zinc, Chemical analysis, Arctic, Heavy metals, Bioindicators, Path of pollutants, Mussels, Public health, *Wolffish, *Anarhichas, *Tissue analysis, *Bioaccumulation, *Fucus, *Mytilus.

Lead concentrations in spotted wolffish (Anarhichas minor) collected from the vicinity of a sphalerite-galena mine and an ore concentration plant in West Greenland have been measured through a period of 2 yr before and 4 yr after mining operations started. Lead levels increased significantly since mining started, and accumulation takes place in liver and kiney, not in muscle tissue. The increased lead levels are not a risk to public health. Small fish have higher lead concentrations than larger ones. (Deal-EIS)
W80-02394

A DIRECT METHOD FOR STUDYING THE EFFECTS OF POLLUTANTS ON THE SEA BED,
J. M. Davies.
Scottish Fishery Bulletin, Vol 45, p 31-32, 1979.

Descriptors: *Waste disposal, *Toxicity, *Benthic fauna, Bottom sediments, Biological communities, Dominant organisms, Sludge disposal, Oil, Oil spills, Oil pollution, Methodology, Analytical techniques, On-site laboratories, *Species diversity.

At the present time the possibility of large scale irreversible contamination of the marine environment by the disposal of waste materials at sea is a controversial subject. The methodology employed in two experiments on the path and effects of pollutants on marine sediments are described. The first series of experiments tested the effects of dumping different doses of sewage sludge on two types of marine sediment. The goal is to determine an acceptable rate of sewage addition which will stimulate benthic production without leading to the drastic drop in diversity normally associated with heavy pollution. In a second series of experiments, the fate of weathered oil sunk onto the sea bottom is being investigated. Both experiments utilize six cylindrical tanks (open top and bottom) placed in the bottom sediments. Samples of the sediment inside the chambers are carried out by divers. Throughout the experiments the numbers and species of bottom living animals are recorded along with an estimate of the total community metabolism measured by oxygen uptake rate. The role of the sediment in recycling nutrients for primary production in the water column is also under investigation. (Deal-EIS)
W80-02398

CHEMICAL AND SUSPENDED-SEDIMENT CHARACTERISTICS OF RIVERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2A.
W80-02400

5C. Effects Of Pollution

HISTORICAL, PHYSICAL, AND CHEMICAL LIMNOLOGY OF TWIN LAKES, COLORADO,
Engineering and Research Center, Denver, CO. Div. of General Research.
J. J. Sartoris, J. F. LaBounty, and H. D. Newkirk.
REC-ERC-77-13, September 1977. 86 p, 58 Fig, 11 Tab, 64 Ref.

Descriptors: *Limnology, *Trophic level, *Sediment-water interfaces, *Water chemistry, *Twin Lakes(CO), *Powerplants, *Environmental effects, Pumped storage, Stratification, Lakes, Colorado, Oxygen, Heavy metals, Water types, Limiting factors, Productivity, Phosphorus, Nutrients, Reduction(Chemical), Oxygen demand.

Upper Twin Lake, Colorado, is presently in trophic disequilibrium. Recently deposited allochthonous organic matter increases sediment oxygen demand so that water is highly reduced during long thermal stratification periods, releasing accu-

mulated iron and manganese quantities and in turn limiting phosphorus availability for primary production. This May 1971-1976 study of Twin Lakes, at Lake Creek, central Colorado, was initiated to obtain limnological data before constructing the Mt. Elbert Pumped-Storage powerplant. Twin Lakes are dimictic, montane, drainage lakes of glacial origin with soft, filute calcium carbonate waters. Heavy metals such as iron, manganese, zinc, copper and lead from naturally exposed mineral deposits are transported to Twin Lakes by Lake Creek. Upper lake secondary productivity is less than that of the lower lake. Upper lake oxygen minima are 6% saturation in winter and 45% in summer; lower lake oxygen minima average 26% in winter and 31% in summer. Upper lake oxygen variation is due to significant woody debris bottom deposits and Lake Creek's influence, flowing into bottom depths during summer stratification and absent in winter due to low flow. During prolonged winter oxygen depletion periods, reducing conditions develop at sediment-water interfaces, causing heavy metal diffusion into water columns. Heavy metals interfere with critical nutrient supplies, limiting phosphorus availability for primary production. (Danovich-Wisconsin)
W80-02049

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. LOWER COOK INLET INTERIM SYNTHESIS REPORT.
Science Applications, Inc., Boulder, CO.
For primary bibliographic entry see Field 5A.
W80-02053

EXISTING DISTRIBUTION AND CONCENTRATION OF POTENTIAL CONTAMINANTS ASSOCIATED WITH PETROLEUM DEVELOPMENT,
Science Applications Inc., Boulder, CO.
For primary bibliographic entry see Field 5B.
W80-02054

CONTAMINANTS AND ENVIRONMENTAL DISTURBANCES THAT MAY ACCOMPANY PETROLEUM EXPLORATION AND DEVELOPMENT,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
For primary bibliographic entry see Field 5B.
W80-02055

GEOLOGICAL HAZARDS TO PETROLEUM EXPLORATION AND DEVELOPMENT IN LOWER COOK INLET,
Science Applications, Inc., Boulder, CO.
For primary bibliographic entry see Field 5B.
W80-02056

TRANSPORT AND ALTERATION OF CONTAMINANT DISCHARGES,
Science Applications, Inc., Boulder CO.
For primary bibliographic entry see Field 5B.
W80-02057

BIOLOGICAL POPULATIONS AND ECOLOGICAL SYSTEMS,
Science Applications, Inc., Boulder, CO.
J. G. Strauch, Jr., E. G. Wolf, and K. W. Fucik.
In: Environmental Assessment of the Alaskan Continental Shelf, Lower Cook Inlet Interim Synthesis Report, p 105-196, July 1979. 106 Fig. NOAA/OCSEAP-03-7-022-35213.

Descriptors: *Resources development, *Aquatic life, *Water pollution effects, *Environmental effects, Ecosystems, Oil pollution, Baseline Studies, Alaska, *Outer Continental Shelf, Petroleum development, Cook Inlet(AK).

OCSEAP's underlying objective is the protection of the environment compatible with oil and gas development. Alaskan ecosystems have evolved over millions of years with minimal human influence. Some of the key considerations are: The offshore Inlet is nearly pollution-free and historically has experienced very little change in environmental conditions. For this reason many organisms may be unable to cope with sudden environmental changes. Because of the currents entering and leaving Cook Inlet, areas along the southern coast of the Alaska Peninsula and the Aleutian Islands would be affected by any major release of contaminants into the Inlet. Kachemak Bay is an important area for hatching and recruitment of fish and invertebrates; it is heavily used by migrant and wintering bird populations. Sea otters are a key species in determining community structure and they are particularly vulnerable to oil contamination. Because of complex food web interrelationships, oil spills affecting one species could affect organisms occupying other trophic levels. Petroleum hydrocarbons and heavy metals could accumulate in some sediments, leading to long-term exposure to benthic organisms. They can also be accumulated at least temporarily within the body tissues of most fish and invertebrates leading to the disruption of food webs. Cook Inlet supports an important fishery. There is a large potential for resource-conflict between the oil and gas industry and commercial and sports fisheries. Finally the Cook Inlet beluga whale population is probably isolated from other populations of the species and may be genetically distinct. It is unlikely that the population would be compensated by migrants from other areas. (See also W80-02053) (Sinha-OEIS)
W80-02058

A SYNTHESIS OF ENVIRONMENTAL INFORMATION CONCERNING POTENTIAL OCS OIL AND GAS DEVELOPMENT IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
For primary bibliographic entry see Field 5B.
W80-02059

EFFECT OF CRUDE OIL ON A LOUISIANA SPARTINA ALTERNIFLORA SALT MARSH,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. D. DeLaune, W. H. Patrick, Jr., and R. J. Buresh.
Environmental Pollution, Vol 20, No 1, p 21-31, September 1979. 1 Fig, 8 Tab, 18 Ref.

Descriptors: *Oil pollution, *Water pollution effects, *Environmental effects, Louisiana, Salt marshes, Grasses, Resources development, Wetlands, *Outer Continental Shelf, Crude oil, Spartina alterniflora.

The effect of Louisiana crude oil on growth of Spartina alterniflora Loisel and selected anaerobic soil processes in a Louisiana salt marsh was investigated. Greenhouse and field studies indicated that S. alterniflora can tolerate a large amount of oil without a short-term decrease in above-ground biomass. Neither the biological reduction of nitrate, manganese, iron and sulphate nor the production of methane and ammonium in stirred reduced sediments were affected by additions of up to 20% oil on a soil-weight basis. Oil placed on the water surface of unstirred sediment caused a release of iron, manganese and ammonium from the sediment to the overlying water due to the absence of oxygen in the water column. (Sinha-OEIS)
W80-02060

EMISSIONS FROM IN SITU BURNING OF CRUDE OIL IN THE ARCTIC,
Tornoto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
T. Day, D. MacKay, S. Nadeau, and R. Thurier.
Water, Air and Soil Pollution, Vol 11, No 2, p 139-152, February 1979. 5 Fig, 5 Tab, 22 Ref.

Descriptors: *Oil pollution, *Oil spills, Air pollution, *Water pollution, *Water quality control, *Arctic, *Burning, Dispersion, Environmental effects, Ice cover, Baseline studies, Resources development, *Outer Continental Shelf, In-situ burning, Crude oil, Beaufort Sea.

The results of an exploratory study of the effects of in situ crude oil spill burning on air quality in the Beaufort Sea region of the Arctic are presented. A scenario is postulated defining the amounts of oil released, the size and number of burnable oil pools, and the duration of the burning period. Estimates are made of the likely emission of soot, CO, SO2 and metals based on literature and some experimental work. Assumptions are made about plume rise and dispersion which permit downwind concentrations of emission to be calculated and compared with air quality objectives. Although the calculated concentrations may contain significant error because of the many assumptions, it is believed that the data demonstrate that concentrations of SO2 and CO will be acceptably low, concentrations of soot and metals will often be undesirably high within 10 km of the fires, but will be acceptably low at greater distances. It is concluded that burning may be a method of substantially reducing the adverse environmental impact of oil spills in the Arctic. (Sinha-OEIS)
W80-02061

A STUDY ON THE EFFECTS OF SALINITY AND TEMPERATURE ON THE DISAPPEARANCE OF AROMATIC HYDROCARBONS FROM THE WATER-SOLUBLE FRACTION OF NO. 2 FUEL OIL,
Texas A and M Univ., College Station. Dept. of Biology.
R. B. Laughlin, Jr., O. Linden, and J. M. Neff.
Chemosphere, Vol 8, No 10, p 741-749, 1979. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Water pollution effects, *Salinity, *Temperature, *Oil pollution, Testing, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, *Aromatic hydrocarbons, Petroleum development, Fuel oil.

How temperature and salinity affect the rate of loss of aromatic hydrocarbons from seawater is discussed. The work was performed in connection with bioassays to examine the interactive effects of petroleum hydrocarbons and the dominant physical factors of salinity and temperature on marine organisms. An empirical approach is used to describe the loss of volatile aromatic hydrocarbons from a static bioassay solution. Using a statistical analysis, the half-time for these compounds in solution has been estimated. Temperature exerted a predominant effect on the loss, although high salinity may exert an interactive effect with temperature. In designing interactive bioassays to test the response of organisms to factorial combinations of petroleum hydrocarbons and physical environmental factors, preliminary experiments of this kind may prove to be extremely useful. They will allow a consistent exposure regime among different factor combinations and a complete enough characterization of exposure for comparison among experiments. (Sinha-OEIS)
W80-02062

THE ALASKAN OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM,
National Oceanic and Atmospheric Administration, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.
R. J. Englemann.
Environmental Conservation, Vol 6, No 3, p 171-180, Autumn 1979. 2 Fig, 20 Ref.

Descriptors: *Resources development, *Environmental effects, *Alaska, *Water pollution effects, *Hazards, Oil pollution, Water quality, Cold regions, Transport, Baseline studies, Aquatic life, Water pollution sources, Sites, Leases, Coasts, *Outer Continental Shelf, *Environmental assessment, Petroleum development.

The Outer Continental Shelf Environmental Assessment Program (OCSEAP) is a multidisciplinary environmental study that is designed to provide timely inputs which are needed for decisions on off-shore oil and gas development. Approximately 100 projects in the Program address six tasks that are universal to environmental prediction and asessment. These include determination of pre-

development contamination, anticipation of future contaminants, transport of contaminants through the environment to receptors, location and character of biological populations, and the effects on organisms of expsoure to a contaminant. The sixth task identifies and characterizes the various physical hazards which the environment poses to human safety, installations, and oil and gas operations. (Sinha-OEIS)
W80-02064

SEWAGE CONTAMINATION IN THE NEW YORK BIGHT. COPROSTANOL AS AN INDICATOR,
National Oceanic and Atmospheric Administrarion, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W80-02065

AN ASSESSMENT OF THE POTENTIAL ENVIRONMENTAL IMPACT OF LARGE-SCALE SAND-DREDGING FOR THE BUILDING OF ARTIFICIAL ISLANDS IN THE NORTH SEA,
Rijksinstituut voor Visserijonderzoek, Ijmuiswn (Netherlands).
S. J. de Groot.
Ocean Management, Vol 5, No 3, p 211-232, October 1979. 4 Fig, 54 Ref.

Descriptors: *Dredging, *Water pollution effects, *Water quality, *Coasts, *Sands, Ecosystems, Fish, Benthos, Plankton, Mining, Resources development, Fisheries, *Outer Continental Shelf, *North Sea, Artificial islands, Environmental impact.

The building of artificial islands is contemplated in the coastal waters of the Netherlands. The potential environmental impact of a large-scale sand-dredging is evaluated. The most suitable mining methods, the effect on water quality-turbidity, the disturbance of the balance between bottom sediment and water column in relation to heavy metals, nutrients and PCB's are discussed, as well as the effect of dredging upon plankton, bottom fauna, fishes and on larvae and young stages of sea animals in general. The recovery time for the bottom fauna is estimated to be about three years. The consequences for the fisheries are mentioned, as the Netherlands coastal zone plays a very important role in the life of the North Sea species. This is related to the Dutch shrimp, plaice and sole fishery. An estimation of the yearly damage to the fisheries during the building phase is made. The building time for the island would be about 8 years. The island would cause damage to fisheries, in respect of a permanent loss of catches of Dfl. 10,000,000. (Sinha-OEIS)
W80-02068

SEDIMENT HYDROCARBONS NEAR AN OIL RIG,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
T. F. Lytle, and J. S. Lytle.
Estuarine and Coastal Marine Science, Vol 9, No 3, p 319-330, September 1979. 3 Fig, 5 Tab, 42 Ref.

Descriptors: *Sediments, *Oil pollution, *Water polluton effects, Texas, Environmental effects, Resources development, *Outer Continental Shelf, *Hydrocarbons, Oil rigs, Environmental impact, Petroleum development.

Sediment samples were collected from 25 strategic locations at a site on the Texas shelf before emplacement of an exploratory oil rig, during drilling and after the rig had been in place for 2 months. These sediments were analysed for aliphatic and aromatic hydrocarbons, and thirteen gas chromatogrphic parameters, used in assessing pollution, were calculated. Graphic cluster analysis, analysis of variance and discriminant analysis were applied to these paramters to view changes as well as to evaluate the effectiveness of gas chromatographic data in monitoring sediment hydrocarbons. Changes discernible by these techniques were slight but more noticeable at stations close to the rig. Hydrocarbons in the C14 to C20 region of the aliphatic chromatograms were in low abudnance in all samples but consisted mostly of n-C17 and C25 branched chain olefins. The high molecular weight region contained high concentrations of the odd carbon numbered n-alkanes with a predominance of n-C29. This similarity to terrestrial hydrocarbons was further confirmed by a mean delta C13 value vs. PDB of -28.0 o/oo for the aliphatic hydrocarbons. (Sinha-OEIS)
W80-02069

ONSHORE IMPACTS OF OFFSHORE OIL: A USER'S GUIDE TO ASSESSMENT METHODS,
D. C. Williams, and K. B. Hom.
Report prepared for U.S. Department of the Interior, Office of Policy Analysis, May 1979. 67 p, 27 Fig. DOI-14-01-0001-78-C-05.

Descriptors: *Resources development, *Planning, *Evaluation, Environmental effects, Water pollution, Shore protection, Baseline studies, *Outer Continental Shelf, Coastal Zone Management, Environmental impact.

This User's Guide describes three principal methodologies for assessing and planning for the onshore impacts of offshore oil: onshore facilities related to offshore oil and gas development; methodology for assessing onshore impacts of offshore outer continental shelf oil and gas development; and environmental planning for offshore oil and gas. The appropriate timing in the OCS process for study and planning, the criteria for approaching the methods, and the extent to which each covers important information needs are discussed. (Sinha-OEIS)
W80-02070

PROGRAMMATIC ENVIRONMENTAL IMPACT ASSESSMENT FOR OPERATIONAL OTEC PLATFORMS - A PROGRESS REPORT,
Interstate Electronics Corp., Anaheim, CA. Oceanic Engineering Div.
M. D. Sands.
In: 'Ocean Thermal Energy for the 80's, Preprints Volume 1, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE Conf-790631/1, p 65-5/1 - 6A-5/4, 1979. 1 Tab, 10 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Resources development, Baseline studies, Sites, Offshore platforms, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OETC), Environmental impact.

As the Ocean Thermal Energy Conversion (OETC) Program advances toward commercialization, the potential environmental impacts of large-scale development must be assessed. Design modifications that will mitigate or reduce potentially adverse effects must be identified and incorporated into the design configurations. In the second phase of Interstate Electronics' OTEC Environmental Impact Assessment Program, the key issues associated with the deployment and operation of demonstration- and commercial-size plants are under evaluation. Presently, three platform design configurations are being considered: a 10 to 20 NWe land-based plant; an industrial plant-ship operation; and a 20 to 400 NWe moored plant. In the program, the land-based plants are to be located on tropical or subtropical islands, while the plant-ships would graze in the open ocean, producing ammonia, hydrogen, or other energy-intensive products. The moored platform will transmit electricity through a cable to a shore-based distribution point. In this assessment, both individual platforms and a mix of the above are being considered for potential siting in the thermal resource regions. Three categories of issues are: social, economic and institutional impacts, environmental impacts, and health and safety on and adjacent to the platforms. (Sinha-OEIS)
W80-02071

OTEC ENVIRONMENTAL AND RESOURCE ASSESSMENT PROGRAM,
Department of Energy, Washington, DC.
L. F. Lewis.
In: 'Ocean Thermal Energy for the 80's,' Preprints Volume 1, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE Conf-790631/1, p 6A-1/1 - 6A-1/4, 1979. 3 Fig 1 Tab, 19 Ref.

Descriptors: *Energy conversion, *Baseline studies, *Environmental effects, *Resources development, Sites, Water quality control, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC).

The Ocean Thermal Energy Conversion (OTEC) Environmental and Resource Assessment Program is that part of the Department of Energy's activity which assesses the Environmental and Resource requirements for continued OTEC development and ensures not only that the appropriate research is done, but also that it matches the scheduled timeframe for development. The initial requirement is to locate possible OTEC sites not only by their available thermal resource and environmental response but also by other considerations such as their operational and survival design requirements. The program ensures that the information on conditions at the sites is acquired and that the best possible estimates of OTEC induced changes are made. The present program plan calls for a significant near term effort in site characterization at locations of probable OTEC deployment. This characterization is undertaken using historically acquired oceanographic data, models, hindcasts and othertechniques to the extent possible. Field measurements are made as necessary, to augment the archival data and, if required, for design and/or environmental assessment. Design requirements and site characterization data provide much of the necessary basis for environmental impact and resource assessments. (Sinha-OEIS)
W80-02072

ENVIRONMENTAL IMPACT ASSESSMENT FOR OTEC-1,
TRW Defense and Space Systems Group, Redondo Beach, CA.
For primary bibliographic entry see Field 5B.
W80-02073

OTEC PHYSICAL AND CLIMATIC ENVIRONMENTAL IMPACTS,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5B.
W80-02074

ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM AT POTENTIAL OTEC SITES,
California Univ., Berkeley. Lawrence Berkeley Lab.
P. Wilde.
In: Ocean Thermal Energy for the 80's, Preprints Volume II, 6th OTEC Ocean Thermal Energy Conversion Conference, held in Washington, DC on June 19-22, 1979. DOE CONF-790631/2, p 6A-4/1 - 6A-4/7, 1979. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Energy conversion, *Environmental effects, *Resources development, Baseline studies, Monitoring, Water quality, Gulf of Mexico, Sites, Outer Continental Shelf, Ocean Thermal Energy Conversion(OTEC), Environmental impact.

Ecologically sound operations of projected Ocean Thermal Energy Conversion (OTEC) plants can be insured by careful attention to the marine environment during the design phase. This requires quality information from regions of potential OTEC interest, coordinated with required assessment studies to insure legal compliance. Currently preliminary or actual surveys and laboratory studies are being conducted in the waters of Puerto Rico, the Gulf of Mexico, Hawaii, and Guam for potential moored or seacoast OTEC plants and in the equatorial South Atlantic for proposed plant-ship operations to provide such benchmark and baseline data. These data plus existing archival information can be used to model effects of OTEC operations based on projected design schemes. Four major areas of concerns (1) redistribution of oceanic properties, (2) chemical pollution, (3)

structural effects, and (4) socio-legal-economic; and 11 key issues associated with OTEC deployment and operation have been identified. In general mitigating strategies can be used to alleviate many deleterious environment effects of operational problems as biostimulation, outgassing, etc. Various assessment research studies on toxicity, biocide releases, etc., are under way or are planned to investigate areas where no clear mitigating strategy is available. Data from the monitoring and assessment programs is being integrated into a series of environmental compliance documents including a comprehensive programmatic environmental impact assessment. (Sinha - OEIS)
W80-02075

METHODS OF UTILIZATION OF WASTE EFFLUENTS FROM MINERAL FERTILIZERS PLANTS IN CARP FRY CULTURES,
Wyzaza Szkola Rolnicza, Szczecin (Poland). Dept. of Hydrozoology.
For primary bibliographic entry see Field 5A.
W80-02078

EFFECT OF CRUDE OIL AND DETERGENT 'SOLO' ON THE ACTIVITY OF SOME HYDROLASES IN HEMOLYMPH OF CRAB RHITHROPANOPEUS HARRISI,
Medical Academy, Gdansk (Poland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-02079

COMMUNITIES OF ORGANISMS DURING TREATMENT OF SEWAGE CONTAINING ANTIBIOTICS,
Panstwowy Zaklad Higieny, Warsaw (Poland). Dept. of Communal Hygiene.
J. Stanislawski.
Polskie Archiwum Hydrobiologii, Vol 26, No 1/2, p 221-229, 1979. 3 Fig, 11 Ref.

Descriptors: *Sewage effluents, *Trickling filters, *Biological communities, Biodegradation, Filters, Waste treatment, Bacteria, Algae, Protozoa, Dominant organisms, Toxicity, *Antibiotics, *Streptomycin, *Penicillin, *Oxytetracycline, *Chloramphenicol, *Tetracycline.

A study was made of the effect of antibiotics (streptomycin and a mixture of penicillin, oxytetracycline, chloramphenicol and tetracycline) on the communities of organisms forming the film in trickling filters during sewage purification. When present in amounts beginning from 10 mg/l of sewage, antibiotics reduce the numbers of organisms (mainly protozoans and invertebrates as well as bacteria and algae). Lower levels of antibiotics (less than 10 mg/l of sewage), occurring in hospital sewage, can also affect the development of the communities of organisms. During biological purification of this sewage, communities of organisms regenerate with time as a result of biochemical degradaton of sewage components. (Deal-EIS)
W80-02081

PHYSIOLOGICAL AND BEHAVIOURAL CHARACTERIZATION OF THE ACTION OF CHLORFENVINPHOS ON FISH LEBISTES RETICULATUS PETERS,
Polish Academy of Sciences, Warsaw. Lab. of Ecological Bioenergetics.
For primary bibliographic entry see Field 5B.
W80-02084

INFUENCE OF TEMPERATURE ON MORPHOLOGY AND PHYSIOLOGY OF SALMONID EMBRYOS, LARVAE AND ALEVINS,
Tikhookeanskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva i Okeanografii, Petropavlovsk-Kamchatskii (USSR).
For primary bibliographic entry see Field 5A.
W80-02085

PHOTOPERIODIC ACCLIMATION AND CIRCADIAN VARIATIONS IN TOLERANCE OF JUVENILE RANBOW TROUT (SALMO GAIRDNERI) TO ZINC,
British Columbia Research Council, Vancouver. Div. of Applied Biology.
For primary bibliographic entry see Field 5A.
W80-02087

DETECTION LIMITS OF A BIOLOGICAL MONITORING SYSTEM BASED ON FISH RESPIRATION,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands). Chemical Biological Div.
For primary bibliographic entry see Field 5A.
W80-02088

TOXICITY AND RETENTION OF DDT IN ADULT FROGS, RANA TEMPORARIA L.,
Kuopio Univ., (Finland).
For primary bibliographic entry see Field 5B.
W80-02090

EFFECTS OF A THERMAL DISCHARGE ON THE MORTALITY OF COPEPODS IN A SUBTROPICAL ESTUARY,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W80-02091

RESISTANCE OF MARINE GASTROPODS TO OXYGEN DEFICIENCY AND HYDROGEN SULPHIDE,
Sao Paulo Univ. (Brazil). Dept. de Fisiologia Geral.
K. Hiroki.
Boletim de Fisiologia Animal, Vol 2, p 33-42, 1978. 3 Fig, 4 Tab, 25 Ref.

Descriptors: *Oygen requirements, *Gastropods, *Hydrogen sulfide, Toxicity, Mortality, Sea water, Water chemistry, Resistance, Animal physiology, Animal metabolism, Animal behavior, *Littorina, *Neritina, *Olivella.

Many molluscs are known to be tolerant to oxygen deficiency. Laboratory experiments were carried out to obtain data on the resistance (LT50) of three gastropod species from the Brazilian coastal waters - Littorina ziczac, Neritina virginea and Olivella verreauxii in sea water poor in oxygen (ca. 0.2 ml/l) and/or hydrogen sulphide containing sea water (50 mg $Na_2S.9H_2O$/l). As a rule, the species were more resistant to oxygen deficiency than to the simultaneous presence of hydrogen sulphide. Neritina virginea was the most resistant species, under all experimental conditions, followed by Littorina ziczac and Olivella verreauxii. (Deal-EIS)
W80-02093

ADAPTATION OF A RECIRCULATING FISH CULTURE SYSTEM TO SALINITY CHANGE,
Biologische Anstalt Helgoland, Hamburg (Gemany, F.R.).
For primary bibliographic entry see Field 5A.
W80-02095

DEVELOPMENT OF ALGAE IN PONDS TREATED WITH FOSCHLOR AND IN PONDS WITH CONTROLLED TIME OF FILL,
Instytut Rybactwa Srodladowego, Zibieniec (Poland). Pond and River Dept.
For primary bibliographic entry see Field 5A.
W80-02096

EFFECT OF COPPER SULFATE AND SODIUM PENTACHLOROPHENATE ON ADENINE AND ADENOSINE PHOSPHATES IN LYMNAEA LUTEOLA (MOLLUSCA: GASTROPODA),
Sri Venkateswara Univ., Tirupati, (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02097

THE INFLUENCE OF AMMONIA WATER ON BACTERIA, PLANKTON AND BOTTOM FAUNA OF PONDS, (IN POLISH),
Instytut Rybactwa Srodladowego. Warsaw (Poland).
For primary bibliographic entry see Field 5A.
W80-02099

CHANGES IN THE ICHTHYOFAUNA OF LAKE ZIOLO AS AN INDEX OF PROGRESSING EUTROPHICATION (IN POLISH),
Akademia Rolniczo-Techniczna, Olsztyn-Lortowo (Poland). Inst. of Hydrobiology and Water Conservation.
S. Dudzinski.
Roczniki Nauk Rolniczych, Vol 99, No 1, p 81-96, 1978. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Eutrophication, *Fishkill, *Fish populations, Toxicity, Mortality, Lakes, Rivers, Sewage effluents, Nutrients, Oxygen sag, Benthic fauna, Eels, Commercial fish, Perches, Pikes, Seasonal, Spawning, Poland, Welna River, Struga Gnieznienska River.

Excessive amounts of wastes introduced in to the rivers Welna and Struga Gnieznienska resulted in eliminating from fishery production lakes situated on their course. These lakes practically play the role of sedimentation tanks. Lack of decisive remedial measures resulted in a total degradation of Lake Ziolo--the first of the Rogowskie Lakes Complex. In the first period introduction of wastes had a beneficial effect increasing the fertility of the lake and its productivity. Further 'fertilization' resulted in oxygen deficits during winter due to the composition of organic matter, and in mass fish kills (first kill was noted in winter 1961). A drastic drop in the production of valuable fish species was noted, so that practically these species disappeared from the lake. Eel was the first to react to unfavourable conditions (in 1957). This species inhabits bottom zone of lakes, buried in the mud, and hence it is most strongly exposed to oxygen deficits. Pike was eliminated from the lake almost simultaneously with eel (in 1959). Decrease of water transparency, caused by the development of phytoplankton, reduced visibility and resulted in unfavourable feeding conditions for pike, and also in reducing its ability to avoid fishing gear. (Deal-EIS)
W80-02100

AN EVALUATION OF THE USEFULNESS OF A POND ENVIRONMENT WITH HEATED WATER FOR REARING OF FISH,
Instytut Rybactwa Srodladowego, Warsaw (Poland).
For primary bibliographic entry see Field 5A.
W80-02101

AN ATTEMPT TO DISINFECT FISH PONDS WITH AMMONIA WATER (IN POLISH),
Instytut Rybactwa Srodladowego, Warsaw (Poland).
For primary bibliographic entry see Field 5A.
W80-02103

THE SENSITIVITY OF FISH EMBRYOS TO THE EFFECT OF TOXICANTS,
Moscow State Univ. (USSR). Special Topics Lab.
For primary bibliographic entry see Field 5A.
W80-02104

AN ASSESSMENT OF KNOWLEDGE CONCERNING THE FATE AND EFFECTS OF PETROLEUM HYDROCARBONS IN THE MARINE ENVIRONMENT,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
For primary bibliographic entry see Field 5A.
W80-02107

PESTICIDES: THEIR IMPACT ON THE ESTUARINE ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02109

MULTIPLE FACTOR INTERACTIONS AND STRESS IN COASTAL SYSTEMS: A REVIEW

OF EXPERIMENTAL APPROACHES AND FIELD IMPLICATIONS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5A.
W80-02111

TEST OF A MODEL FOR PREDICTING KEPONE ACCUMULATION IN SELECTED ESTUARINE SPECIES,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5A.
W80-02113

BIOCONCENTRATION AND METABOLISM OF LINEAR ALKYLBENZENE SULFONATE BY DAPHNIDS AND FATHEAD MINNOWS,
Monsanto Co., St. Louis, MO.
R. M. Comotto, R. A. Kimerle, and R. D. Swisher.
In: Aquatic Toxicology, L. L. Marking and R. A. Kimerle, Eds., American Society for Testing and Materials, STP 667, p 232-250, 1979. 8 Fig, 4 Tab, 28 Ref.

Descriptors: *Alkylbenzene sulfonates, *Daphnia, *Minnows, Biodegradation, Animal metabolism, Surfactants, Tracers, Absorption, Carbon radioisotopes, Gas chromatography, Path of pollutants, *Bioconcentration, *Tissue analysis.

The bioconcentration potential of the anionic surfactant linear alkylbenzene sulfonate (LAS) was studied using daphnids (Daphnia magna) and fathead minnows (Pimephales promelas) in studies extending up to 50 days. Uptake in the test organisms, as measured by 14C activity, was a function of chain length and exposure concentration. In whole organisms, the dry weight bioconcentration factors (BCF) were 500 to 4000 for daphnids and 200 to 2000 for fathead minnows. In fish tissues, the greatest 14C activity occurred in the gall bladder, the BCFs ranging from 20,000 to 70,000, while the least occurred in the muscle, the BCFs remaining in the range of 100 to 400. In depuration studies, greater than 85 percent of the 14C content was cleared from all tissues within three to four days, with nearly 100 percent clearance within ten days. The results of desulfonation/gas chromatography analyses of tissues suggested that the fathead minnows metabolised LAS, and the daphnids did not. From the present studies and from previously reported toxicity and microbial biodegradation studies, it can be further concluded that under environmental conditions there is little likelihood that LAS bioconcentration creates a hazard to aquatic ecosystems. (Deal-EIS)
W80-02114

AN APPROACH TO THE TOXICOLOGICAL EVALUATION OF A COMPLEX INDUSTRIAL WASTEWATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5A.
W80-02117

ORGANOCHLORINE CONTAMINANTS AND TRENDS IN REPRODUCTION IN GREAT LAKES HERRING GULLS, 1974-1978,
Department of Fisheries and Environment, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W80-02123

CHANGES IN SPECIES COMPOSITION OF GREAT LAKES FISH COMMUNITIES CAUSED BY MAN,
Toronto Univ.(Ontario). Inst. for Environmental Studies.
H. A. Regier.
Transactions of the Forty-fourth North American Wildlife and Natural Resources Conference, p 558-566, 1979. K. Sabol, Ed., 15 Ref.

Descriptors: *Great Lakes, *Fish management, *Water quality control, Commercial fishing, Fish populations, Dominant organisms, Water pollution effects, Benthic flora, Benthic fauna, Biological communities, Eutrophication, Industrial wastes, Chemical wastes, Channel improvement, Ecosystems, Water quality, Water quality standards, *Species diversity.

Overall the change in the fish associations in the Great Lakes during the past two centuries has involved a massive shift from high-valued, large, long-lived, benthic species to low valued, small, short-lived pelagic species. Though fishery enterprises, both commercial and sport, have found ways to use some of the species that are currently dominant, a return to the earlier association is generally held to be a desirable goal on economic grounds. But what the relative economic benefits would be has not yet been fully assessed. The long list of stressful human activities presented have often interacted additively or even synergistically to effect the overall transformation of the fish association. It helps to explain why all the piecemeal and uncoordinated attempts to 'manage' the Great Lakes fisheries heretofore have been relatively ineffective. Presumably a similar reason underlies the lack of significant progress in the Great Lakes cleanup program, where qualities other than the relative value of fish stocks are of primary consideration. (Deal-EIS)
W80-02124

CRITICAL FACTORS IN THE TRANSPORT OF LIVE FRESHWATER FISH--II. STATE OF FEEDING AND AMMONIA EXCRETION,
Ministry of Agriculture, Fisheries and Food, London (England). Salmon and Freshwater Fisheries Lab.
For primary bibliographic entry see Field 5A.
W80-02126

NUTRIENT BUDGETS AND THE EFFECTS OF DEVELOPMENT ON TROPHIC CONDITIONS IN LAKES,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
D. B. Aulenbach.
Rensselaer Fresh Water Institute Report 79-2, 1979. 34 p, 6 Fig, 8 Tab, 19 Ref.

Descriptors: *Saratoga Lake(NY), *Eutrophication, *Lake George(NY), *Sewage treatment, *Trophic level, *Land development, Lakes, Water pollution sources, Nutrients, Urban runoff, Urbanization, Land use, Sewage disposal, Treatment facilities, Oligotrophy, Construction, Sewage districts, Sewerage, Water quality, Water policy, Planning.

Massive funding of U.S. wastewater treatment systems may not result in pristine lakes; efforts may improve water quality in some lakes, while in other instances, ensuing development allowed by treatment plant and sewer construction may actually cause additional eutrophication. Sewage treatment construction impacts were evaluated for Saratoga Lake and Lake George, eastern New York. Although they are only 40 km apart, Saratoga Lake is highly eutrophic whereas Lake George is oligotrophic to mesotrophic. Saratoga Lake has 15.6 sq km surface area, 544 sq km drainage area, 8 m average depth, and 130 day hydraulic detention time. Lake George has 114 sq km surface area, 492 sq km drainage area, 18 m average depth, and 8.0 year hydraulic detention time. Saratoga Lake has 28,942 kg/yr total phosphorus (P) load and 340,357 kg/yr total nitrogen (N) load compared with 13,096 kg P/yr and 197,420 kg N/yr for Lake George. Largest nutrient loads for both lakes are from non-point sources. Sewage treatment plant construction plans were drawn up for both lakes; the plans would divert all direct discharges from the lakes. Construction definitely reduces Saratoga nutrient loading; however, not enough to bring it out of eutrophic range. Sewage treatment plant construction in Lake George with ensuing allowable development and would actually increase loads due to high P concentrations in urban runoff. Therefore, treatment facility construction should include plans preventing additional P loadings due to development and urban runoff. (Danovich-Wisconsin
W80-02127

STUDIES OF CARBON AND NITROGEN METABOLISM BY THREE MARINE PHYTOPLANKTON SPECIES IN NITRATE-LIMITED CONTINUOUS CULTURE,
Hawaii Univ., Honolulu. Dept. of Oceanography.
E. A. Laws, and D. C. L. Wong.
Journal of Phycology, Vol 14, No 4, p 406-416, 1978. 5 Fig, 3 Tab, 33 Ref. NSF DES75-20844, EPA R800906.

Descriptors: *Metabolism, *Nutrient kinetics, *Phytoplankton, *Carbon, *Nitrogen, *Laboratory tests, Chlorophyll, Cultures, Plant growth, Growth rates, Nitrates, Diatoms, Respiration, Productivity, Kinetics, Organic matter, Chlorophyta, Michaelis-Menten equations, Nutrients, Nutrient requirements.

Thalassiosira allenii cultures show 0.1-0.2 ratio of dark carbon (C) loss to daytime net C production over 0.005-0.06/h growth rate range. For Monochrysis lutheri and Dunaliella tertiolecta, the loss/production ratio is 0.2-0.3 with 0.005-0.025/h growth rates; however, the latter ratio declines at higher growth rates when dark nitrate uptake cell capacity exceeds pumping rates. Lower C production efficiency of M. lutheri and D. tertiolecta vs. T. allenii helps explain why the first two species are largely confined to tidal pool environments, where resistance to fluctuations in temperature and salinity enables them to survive, but are rarely found in offshore waters where they must compete with more efficient C-producing species. The study observes C and Nitrogen (N) metabolism of marine phytoplankton, grown on light/dark cycles in continuous flow systems at different growth rates. Populations are uniformly labeled with C14 to facilitate C production, respiration, and excretion studies. C excretion rates are quite low compared to respiration rates, averaging 1% of daytime net production for T. allenii and M. lutheri and 1.4% for D. tertiolecta. Productivity indices do not correlate with growth rate due to significant positive correlation between chlorophyll-a:C ratios and growth rate. Dark nitrate maximum uptake rates (V-max) for M. lutheri, D. tertiolecta and T. allenii average 23%, 64%, and 120% respectively, of light nitrate V-max. Diurnal periodicity in V-max for T. allenii is partially due to changes in enzyme activity. (Danovich-Wisconsin)
W80-02128

HYDROLOGICAL STRUCTURE ANALYSIS FOR ESTIMATING THE PRIMARY PRODUCTION IN THE TROPICAL ATLANTIC OCEAN,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.
A. Herbland, and B. Voituriez.
Journal of Marine Research, Vol 37, No 1, p 87-101, 1979. 10 Fig, 1 Tab, 21 Ref.

Descriptors: *Chlorophyll, *Primary productivity, *Atlantic Ocean, *Tropical regions, *Nitrates, *Environmental gradient, *Phytoplankton, *Biomass, Oxygen, Light, Light intensity, Epilimnion, Thermocline, Stratification, Regression analysis, Correlation analysis, Equations, Photosynthesis, Africa, Nutrients.

Hydrologic structure analysis in tropical Atlantic Ocean eutrophic layers facilitates rough phytoplankton biomass and production estimates in the water column from any vertical nitrate, nitrite, fluorescence, oxygen, and temperature profiles. The paper describes relationships defining chlorophyll and primary production profiles taken from data by R.V. Capricorne in five cruises off Africa 1973-1977. Chlorophyll profiles show a regular deep maximum near the bottom of the mixed layer; values range 0.05-0.15 micro g/l in mixed layers and can reach 1 micro g/l. The top of the nitracline (nitrate gradient) is associated with the chlorophyll maximum. Maximum chlorophyll depth and maximal photosynthetic activity depths are statistically equal, giving evidence of the importance of nitracline which is the best lighted nutrient-rich layer in the water column. When the nitrate-depleted layer is deep (60 m), primary production maximum is undetectable. Stability limits the degree of vertical mixing and, therefore, controls nitracline depth. When vertical advection is

negligible, nitracline and thermal maximum gradient (TMG) depths are related. The top of the nitracline stands below the TMG when it is close to the surface. When the TMG is deep, the top of the nitracline stands above the TMG. The nitrate primary maximum is located 10-12 m below the top of the nitracline in decreasing chlorophyll concentrations where light limits primary production. It defines the bottom of the euphotic layer. (Danovich-Wisconsin)
W80-02129

THE EFFECT OF SEWAGE SPRAY IRRIGATION ON DISEASE VECTORS - JULY 1975 - DECEMBER 1978,
Michigan State Univ., East Lansing, Dept. of Entomology.
For primary bibliographic entry see Field 3C.
W80-02156

STRESS AND CHRONIC EFFECTS OF UNTREATED AND TREATED BLEACHED KRAFT PULPMILL EFFLUENT ON THE BIOCHEMISTRY AND STAMINA OF JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH),
British Columbia Research Council, Vancouver. Div. of Applied Biology.
For primary bibliographic entry see Field 5B.
W80-02211

CHLORINATED PARAFFINS-AN ENVIRONMENTAL HAZARD,
National Swedish Environment Protection Board, Studsvik. Brackish Water Toxicology Lab.
For primary bibliographic entry see Field 5A.
W80-02214

MERCURY IN WATER AND FISH FROM THE SAO VINCENTE ESTUARY NEAR SANTOS, BRAZIL,
Instituto de Pesca, Santos (Brazil). Coordenadoria de Pesquisa de Recursos Naturais,
For primary bibliographic entry see Field 5A.
W80-02215

RESPONSES TO SALINITY IN LARVAE FROM THREE LOCAL POPULATIONS OF THE FRESHWATER SHRIMP, MACROBRACHIUM NIPPONENSE,
Tokyo Univ. of Fisheries (Japan). Fisheries Resources Research Lab.
For primary bibliographic entry see Field 5A.
W80-02216

NIFURPIRINOL (FURANACE; P-7138) RELATED LESIONS ON CHANNEL CATFISH ICTALURUS PUNCTATUS (RAFINESQUE),
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5B.
W80-02222

POISONING OF WILD BIRDS BY ORGANOPHOSPHATE AND CARBAMATE PESTICIDES,
New York State Dept. of Environmental Conservation, Albany.
W. B. Stone.
New York Fish & Game Journal, Vol 26, No 1, p 37-47, 1979. 1 Fig, 7 Ref.

Descriptors: *Pesticides, *Insecticides, *Waterfowl, Organophosphorous pesticides, *Mammals, *Industrial wastes, Carbofuran, Bioassay, On-site-investigation, Mallards, Canada geese, Frogs, Mergansers, Aquatic insects, Ducks, Woodchuck, Raccoons, Skunks.

Eight instances are reported in which organophosphate or carbamate (cholinesterase inhibitor) pesticides applied for various purposes killed wild birds. It is believed that thousands of birds are being killed in this way, and more such cases are anticipated because of the widespread use, and often misuse, of these pesticides. Methods are suggested for investigating wildlife poisonings of this sort. Recorded are cases of water fowl killed in lawns, Canada geese killed on golf courses and birds killed at industrial lagoons. The lagoon was contaminated by carbofuran. The waters were toxic not only to birds, but to fish, aquatic insects, and mammals including woodchucks, raccoons, and skunks. (Katz-EIS).
W80-02223

SOME STUDIES ON THE HEPATIC MICROSOMAL ENZYME ACTIVITIES AND STEROID HORMONE LEVELS IN CARP, CYPRINUS CARPIO EXPOSED FOR SIX MONTHS,
London Univ. (England).
For primary bibliographic entry see Field 5A.
W80-02225

EFFECTS OF TEMPERATURE AND STOCKING DENSITY ON FOOD CONSUMPTION AND GROWTH OF GRASS CARP CTENOPHARYNGODON IDELLA, VAL.,
Arkansas Univ., Fayetteville. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-02226

INFLUENCE OF SOCIAL RANK ON THE BEHAVIOUR OF BLUEGILL, LEPOMIS MACROCHIRUS RAFINESQUE EXPOSED TO SUBLETHAL CONCENTRATIONS OF CADMIUM AND ZINC,
Iowa State Univ., Ames. Dept. of Animal Ecology.
M. G. Henry, and G. J. Atchison.
Journal of Fish Biology, Vol 15, p 309-315, 1979. 2 Tab, 31 Ref.

Descriptors: *Fish behavior, *Toxicity, *Heavy metals, *Cadmium, *Zinc, Sunfishes, Mode of action, Social behavior(Animal), Animal behavior, Fish physiology, Fish populations, *Social rank, *Hierarchy.

The influence of social rank on changes in Lepomis macrochirus behaviour brought about by exposure to sublethal concentrations of cadmium and zinc was studied. Significant changes occurred in the frequency of eight of the nine behavioural acts quantified. The effects of metals on the behaviour of individuals was often related to the individual's social status in the hierarchies that had formed. The majority of agonistic behaviours (nips and nudges) were performed by dominant individuals and the majority of comfort behaviours (coughs, yawns, jerks, jerk swimming, fin flickering and chafes) occurred in subordinate individuals. These differences occurred during the control period as well as the treatment period and are thought to be in part caused by socially induced stress. (Deal-EIS).
W80-02227

STUDY OF THE EFFECTS OF MINING AND MILLING OPERATIONS ON HIGH MOUNTAIN STREAMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
For primary bibliographic entry see Field 5A.
W80-02250

STUDY OF THE EFFECTS OF METALIC IONS ON FISH AND AQUATIC ORGANISMS,
Colorado Dept. of Natural Resources, Fort Collins. Div. of Wildlife.
For primary bibliographic entry see Field 5A.
W80-02251

KINETICS OF NITROGEN-LIMITED ALGAL GROWTH,
Vandkvalitetsinstitutet, Hoersholm (Denmark).
N. Nyholm.
Progress in Water Technology, Vol 8, No 4-5, p 347-358, 1977. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Kinetics, *Nitrogen, *Limiting factors, *Growth rates, *Cycling nutrients, Mathematical models, Algae, Phytoplankton, Nutrients, Cytological studies, Biochemistry.

The specific growth rate of nitrogen-limited cells is a linear function of intracellular nitrogen concentration expressed as total cellular nitrogen per cell dryweight. When nitrogen is no longer limiting, cells adjust their uptake rate and incorporate nitrogen in proportion to growth. Specific intracellular nitrogen content is a dynamic quantity which controls growth rate. Seven sets of data from continuos culture studies were taken from the literature. The Nyholm model, previously used to describe growth of phosphorus-limited algae, was applied to nitrogen-limited growth with first-order reaction kinetics. The purpose of this research was to study the relationship between algal growth rate and the supply of limiting nutrients. It includes intracellular nitrogen content as a state variable and assumes that when nitrogen is limiting, all available nitrogen is incorporated into the cells (therefore, eliminating the need for uptake kinetics). When nitrogen is present in excess, uptake is proportional to growth. The intracellular nitrogen was divided into two fractions: a structural substrate which equals the total substrate content when the growth rate is zero, and a residual or active substrate which converts to structural nitrogen in proportion to growth. Batch and chemostat experiments were simulated. The biomass was expressed as carbon in four sets of data and dryweight in the others. (Danovich-Wisconsin).
W80-02252

THE EFFECTS OF A COAL FIRED POWER PLANT ON WETLANDS,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
D. E. Willard.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 37-44, 1978. 7 Fig.

Descriptors: *Wetlands, *Power plants, *Thermal pollution, *Environmental effects, Freshwater marshes, Vegetation effects, Marshes, Birds, Fish, Water level fluctuations, Wisconsin.

The physical impacts to the wetlands adjacent to the Columbia River Power Plant near Portage, Wisconsin, are similar to those caused by highway, subdivision, or water control device construction. The thermal pollution is specific. These impacts acting together cause an increase in water level, a reduction of annual fluctuation, and anachronistic warming. The effect of the resultant change in vegetation on fish and bird species composition has not yet been determined. (See also W80-02253) (Howard-Mass).
W80-02259

SAN FRANCISCO BAY: THE WETLANDS BESEIGED,
For primary bibliographic entry see Field 6G.
W80-02278

THE ENVIRONMENTAL FATE OF THREE DICHLOROPHENYL NITROPHENYL ETHER HERBICIDES IN A RICE PADDY MODEL ECOSYSTEM,
Illinois Univ. at Urbana-Champaign. Dept. of Entomology.
A. H. Lee, P. Y. Lu, R. L. Metcalf, and E. L. Hsu.
Journal of Environmental Quality, Vol 5, No 4, p 482-486, October-December, 1976. 2 Fig, 4 Tab, 23 Ref.

Descriptors: *Wetlands, *Rice, *Herbicides, *Environmental effects, *Model studies, Rooted aquatic plants, Toxicity, Degradation, Ecology, Ecological distribution, Ecosystems.

Of three carbon-14 radiolabeled diphenyl ether herbicides, tissue storage of bifenox was minimal under laboratory rice paddy model ecosystem conditions. The carbomethoxy group of this compound served as an effective degradophore. Nitrofen and methoxy-nitrofen were relatively stable and were bioconcentrated and stored over a 33-day period in tissues of algae, snail, mosquito, and fish. Nitrofen showed high toxicity to rice plants. Methoxy-nitrofen and bifenox did not affect the rice but were toxic to algae. (Howard-Mass)

W80-02301

PERSISTENCE AND FACTORS AFFECTING DISSIPATION OF MOLINATE UNDER FLOODED RICE CULTURE,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
L. E. Deuel, F. T. Turner, K. W. Brown, and J. D. Price.
Journal of Environmental Quality, Vol 7, No 3, p 373-377, July-September, 1978. 2 Fig, 5 Tab, 7 Ref.

Descriptors: *Wetlands, *Rice, *Pesticides, *Environmental effects, Persistence, Degradation(Decomposition), Agriculture, Rooted aquatic plants, Ecology.

Pesticides, essential for the economical production of rice (Oryza sativa L.), could pose a serious problem if transported to surface impoundments and estuaries along the Gulf Coast via the return flow associated with flooded rice culture. Field experiments were conducted under flooded rice cultivation to determine persistence and half-life of molinate (S-ethyl-hexahydro-1-H-azepine-1-carbothioate). Persistence and half-life were evaluated with respect to intermittent and continuous flow irrigation schemes at normal and excessive application rates of 3.4 and 11.2 kg/ha molinate, respectively. Persistence at statistically significant levels ranged from 96 to 384 hours following the application, and generally was more a function of the application rate than irrigation scheme. Half-life values averaged 96 + 22 hours in intermittent flow plots, and 54 + 17 hours in continuous flow plots over the 3-year experiment. Application rate had little effect on half-life. Best fit analysis of field data to the first order biological decay equation and laboratory studies under flooded soil conditions suggested that biological degradation was the principle mode by which molinate was dissipated in the field experiment. (Howard-Mass)
W80-02302

COMBINED ACTION OF POLYPHENOILS, QUINONES, REDUCERS AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5F.
W80-02331

LINKAGES BETWEEN THE ECONOMY AND THE ENVIRONMENT OF THE COASTAL ZONE OF MISSISSIPPI. PART II: ENVIRONMENTAL MODEL.
University of Southern Mississippi, Hattiesburg. Bureau of Business Research.
E. Nissan, D. C. Williams, Jr., and T. Green.
Mississippi-Alabama Sea Grant Consortium Report No MASGP-78-041, Interim Technical Report, June 1979. 150 p, 10 Tab, 53 Ref, 2 Append.

Descriptors: *Economy, *Coasts, *Environments, *Models, Pollutants, Air pollution, Water pollution, Mississippi, Alabama, Coastal zone, Solid waste pollution, Sea Grant program.

This report is the middle link of three projects and its purpose is to determine the physical magnitudes of air, water and solid waste pollution generated through the economic activities of the coastal region of Mississippi. This is necessary for the subsequent stage where the linkage between the economic and environmental parts will be undertaken. Water effluent information gathered in this report was based primarily upon actual data provided by the Mississippi Air and Water Pollution Control Commission obtained as part of their monitoring of producing establishments. Other vehicles for collecting data had to be used such as secondary sources. Some information was collected by personal contacts with engineers and experts in this field. (NOAA)
W80-02367

STUDY OF THE MORTALITY OF ZOOPLANKTON PASSING THROUGH THE COOLING WATER SYSTEM OF A THERMOELECTRIC POWERPLANT, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
R. Gaudy, and B. Moatti.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco. 24-27 Novembre 1978, Antalya, Turkee, p 399-403, 1979. 2 Fig, 12 Ref. (English Summary).

Descriptors: *Mortality, *Zooplankton, *Entrainment, Powerplants, Cooling waters, Sampling, Analytical techniques, Methodology, Thermal stress, Heated water, Chlorination, Turbulence, Water circulation, France, Gulf of Fos.

The mortality of zooplankton sampled from intake and effluent circuits of a power plant (Martigues-Ponteau, Gulf of Fos, France) has been followed during a 18 months study. A vital staining technic was used to determine the proportion of dead and live animals under different conditions of the central activity. The sampling process, adding with the natural mortality caused a mortality rate of 25%. The lethal factors introduced by the cooling water system were the turbulence (mechanical shock in the circuits):21%-the thermal shock, whose the effect is correlated with the increase of delta t (about 0 to 12%)-the chlorination (31% as an average). The mortality appeared to affect in the same way larger and smaller forms of zooplankton. These results are discussed and compared with previous estimations. (Deal-EIS)
W80-02370

ZOOPLANKTON COMMUNITIES OF THE NW ADRIATIC INSHORE WATERS NEAR DUBROVNIK,
Biological Inst. Dubrovnik (Yugoslavia).
A. Benovic, T. Gamulin, J. Hure, F. Krsinic, and B. Skaramuca.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 November 1978, Antalya, Turkee, p 391-398, 1979. 4 Fig, 1 Tab, 3 Ref.

Descriptors: *Zooplankton, *Biological communities, *Baseline studies, Seasonal, Domestic wastes, Dominant organisms, Growth stages, Copepods, Biomass, Crustaceans, Water circulation, *Yugoslovia, *Adriatic Sea, Dubrovnik.

As a part of the coordinated FAO (GFCM) UNEP MED-V Pilot Project, research has been undertaken on marine zooplankton communities in the Dubrovnik area (Yugoslavia). The station grid covers the NW part of Dubrovnik, an area characterized by the polluted harbour of Gruz, the mouth of the Dubrovacka river, and an island area influenced by deep Southern Adriatic currents. Microzooplankton as well as net-zooplankton data indicate winter inflow of the offshore waters and rather minimal influx of fresh and polluted water from the river mouth and the city harbour in the summertime. It was possible to trace some changes of qualitative and quantitative composition of zooplankton communities resulting from polluted waters as well as some changes due to fresh water influx. (Deal-EIS)
W80-02371

A PROBABILISTIC ASSESSMENT OF METHYL MERCURY TOXICITY RESULTING FROM THE CONSUMPTION OF TUNA FISH,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. of Protection.
R. Magnaval, R. Batti, A. Guezengar, R. Bittel, and A. Bouville.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27, Novembre 1978. Antalya, Turkee, p 663-666, 1979.

Descriptors: *Mercury, *Toxicity, *Simulation analysis, Statistical analysis, Analytical techniques, Heavy metals, Probability, Monte Carlo method, Path of pollutants, Public Health, *Methylmercury.

The toxicity of methyl mercury is sufficiently high at low doses to justify an evaluation of the risk related to the various parameters pertaining to the consumption of contaminated food. The originality of the method lies in the fact that distribution frequencies are assigned to the parameters in question, rather than mean values. The total body burden is evalutaed by numerical simulation on a digital computer (Monte Carlo method). Based on recorded cases of incipient intoxication and allowing a safety factor of 10, the critical body burden has been estimated between 5.4 and 6 mg total mercury. By applying this simulation in the case of Mediterranean red tuna fish consumption, it appears that there exists a critical group, as the population consumes this species of fish repeatedly. Toxic levels are never reached. (Deal-EIS)
W80-02373

FISH EGGS DIMENSIONS AND POLLUTION,
Athens Univ., (Greece). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W80-02375

INVESTIGATION OF THE FATE OF SOME CHLORINATED HYDROCARBONS IN LABORATORY GROWN PHYTOPLANKTON CULTURE,
Institut Rudjer Boskovic, Rovinj (Yugoslavia). Center for Marine Research.
M. Picer, N. Picer, F. Krsinic, and V. Sipos.
In: IVes journees d'eutdes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978. Antalya, Turkee, p 453-456, 1979. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Laboratory tests, *Methodology, *Path of pollutants, DDT, DDE, Dieldrin, Aroclors, Polychlorinated biphenyls, Phytoplankton, Research equipment, Chlorinated hydrocarbon pesticides, Pesticide kinetics.

The fate of DDT and its metabolites DDE and TDE as well as dieldrin and Aroclor 1254 in laboratory cultures is described. The equipment used in phytoplankton culture studies was analysed to determine what percentage of the pollutants was taken up by the equipment. The range of pollutants recovered from filters, flasks, caps, and other equipment was extremely high. For example, from 3 to 29% of the DDT in an experiment was recovered in this manner. The problems generated by this high variability in interpreting experimental results are briefly discussed. (Deal-EIS)
W80-02376

ON THE EFFECTS OF DDT ON ENZYME ACTIVITIES IN MUGIL CEPHALUS L.,
Institut za Oceanografiju i Ribarstvo, Split (Yugoslavia).
For primary bibliographic entry see Field 5B.
W80-02377

EUTROPHICATION IN A BRACKISH DELTA LAKE,
Alexandria Inst. of Oceanography and Fisheries (Egypt).
Y. Halim, and S. K. Guerguess.
In: IVee journees detudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L' Exploration Scientifique De La Mer Mediterranee, Mkonaco, 24-27 November 1978, Antalya, Turkee, p 435-438, 1979. 4 Fig.

Descriptors: *Eutrophication, *Lakes, *Sewage effluents, Aquatic populations, Biological communities, Dominant organisms, Tilapia, Shrimp, Phytoplankton, Diatoms, Water chemistry, Dissolved oxygen, Chlorophyta, Nutrients, Phosphates, Mediterranean Lake Menzalah, Nile River, Damietta Nile Branch, Public health.

Lake Menzalah, an extensive but shallow coastal lake located east of the Damietta Nile branch, derives its waters from agricultural drainage which ultimately outflows to the Mediterranean through four lake-sea connections. Its approximate flushing time is three months. About 110,000.000 cu m of

treated and diluted sewage water are discharged monthly into its S E basin. Nearly anoxic and azoic conditions prevail around the outfall, but rapid recovery follows the heavy development of plant life within a few dilometres: submerged macrophytes (Potamogeton, Ceratophyllum) with a dense growth of epiphytic diatoms, and phytoplankton (diatoms and green algae). The DO rises to near saturation but the Euglene/phytoplankton index is high, 1:25, compared to that of the remote lake basin, 1:300. Animal life is abundant in the recovery zone, characterized by herbivores, particle and detrital feeders: the rotifer Brachyonus ealycyflorus, mysis of Palaemonetes sp, the hydrophyte epizoans Vorticella sp and Gammarus sp. The S E lake basin is outstandingly productive in Tilapia fish, but infectious diseases appear to be a hazard to humans. The ecosystem is outlined. (Deal-EIS)
W80-02378

THE BENTHOS OF RIJEKA BAY - SUBJECT TO STRESS OF POLLUTION,
Institut Rudjer Boskovic, Rovinj (Yugoslavia).
D. Zavodnik, and N. Zavodnik.
In: IVes journees d'etudes sur les pollutions marines en Mediterranee, Commission Internationale Pour L'Exploration Scientifique De La Mer Mediterranee, Monaco, 24-27 Novembre 1978, Antalya, Turkee, p 405-410, 1979. 23 Ref.

Descriptors: *Benthic fauna, *Benthic flora, *Water pollution effects, Biological communities, Aquatic populations, Dominant organisms, Sewage effluents, Industrial wastes, Benthos, Littoral, Bays, Habitats, Spatial distribution, Temporal distribution, Jugoslavia, Bay of Rijeka, *Biocoenoses.

The benthic Community of Rijeka Bay (Yugoslavia) was studied for the effects of industrial and domestic pollution. In the Bay of Rijeka, benthic communities are directly affected by domestic sewages and industrial wastes only in the mediolittoral and upper infralittoral zones. The degradation of biocoenoses is reflected by their conversion to nitrophile facia, and by the narrowing of the vertical distribution pattern of seaweed associations. Coastal communities affected by pollution are generally distributed in Bakar Bay and along the north and north-western coasts of Rijeka Bay. Other parts of Rijeka Bay are considered as still not seriously affected by pollution. The specific vertical and horizontal distribution of pollution affected zones and areas respectively, depend on the system of steady currents in the water body. Benthic communities in greater depths (usually below 20 m), are affected locally by silting and near-the-bottom microphytes, to which an increased presence of nutrients and other environmental conditions can give rise. (Deal-EIS)
W80-02379

RECOVERY OF INVERTEBRATE AND VERTEBRATE POPULATIONS IN A COAL ASH STRESSED DRAINAGE SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, S. R. Larrick, R. K. Guthrie, E. M. Davis, and F. F. Sherberger.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1089-1096, 1979. 2 Fig, 3 Tab, 30 Ref.

Descriptors: *Invertebrates, *Fish populations, *Toxicity, *Livebearers, Coal, Fossil fuels, Aquatic populations, Acidic water, Industrial wastes, Hydrogen ion concentration, Diptera, Waste treatment, Water quality, Aquatic insects, Copper, Zinc, *Coal ash, *Fly ash, *Mosquitofish, *Bioaccumulation, *Tissue analysis.

The influence of coal ash effluent upon the densities of macrobenthic invertebrate and mosquitofish (Gambusia affinis) populations in a swamp drainage system was studied for a period of 50 mo. Density of the aquatic biota was periodically altered by three major perturbations: (1) heavy ash siltation from inefficient basin operation, (2) lowered pH from the fly ash addition, and (3) coal ash associated elemental concentrations. Siltation appeared to be most influential in reducing the invertebrate densities while low pH (mean change from 7.2 to 5.5 extreme of 3.5) was more effective in reducing mosquitofish populations and retarding the recovery of invertebrates. Dipterans and odonates were the invertebrates most tolerant to coal ash stress. Upon the completion of an efficient primary-secondary retaining basin system, most invertebrate groups in the swamp were able to recover to a level of abundance equal to or greater than that which existed 4 yr earlier. (Deal-EIS)
W80-02381

CHANGES IN THE APPARENT TEMPERATURE OPTIMA OF THE PLANKTON OF LAKE MICHIGAN AT CHICAGO, ILLINOIS,
State Univ. of New York Coll. at Brockport. Dept. of Biological Sciences.
J. C. Makarewicz, R. I. Baybutt, and K. Damann.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1169-1173, 1979. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Phytoplankton, *Water temperature, *Dominant organisms, Lake Michigan, Seasonal, Habitats, Biological communities, Productivity, Cyanophyta, Diatoms, Great lakes, Plankton, Temperature, Optima, Chicago, Illinois, Stephanodiscus, Asterionella, Fragilaria.

Forty years (1937-76) of data from Lake Michigan water intakes at Chicago, Illinois, were examined to explain reported differences in the apparent temperature optima of phytoplankton. The bimodal seasonal plankton distribution, typical at Chicago, still occurs. However, there has been a shift in seasonal periodicity with spring peaks occurring in March from 1957 to 1976 instead of May-June as previously reported for 1937-56. An optimum temperature of 10C for the plankton community was observed between 1936 and 1956, while for the last 20 yr an optimum temperature range from 0 to 4C was observed. This change in optimum temperature of the plankton community is related to a change in the abundance of the genera Asterionella, Fragilaria, Stephanodiscus, and Tabellaria, Asterionella and Fragilaria were the dominant spring plankton with maximum standing crops observed around 10C prior to 1956. Stephanodiscus first increased significantly in 1957 and was the dominant spring plankter through 1976. More recently (1972-76), blue-green algae have increased in numbers. Differences in apparent temperature optima reported are real and are caused by the emergence of cold water species of Stephanodiscus as the dominant spring plankter from 1957 to 1976. (Deal-EIS)
W80-02382

EFFECTS OF THERMALLY ELEVATED DISCHARGES ON THE STRUCTURE AND COMPOSITION OF ESTUARINE PERIPHYTON DIATOM ASSEMBLAGES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.
M. K. Hein, and J. D. Koppen.
Estuarine and Coastal Marine Science, Vol 9, p 385-401, 1979. 7 Fig, 2 Tab, 32 Ref.

Descriptors: *Diatoms, *Nuclear powerplants, *Dominant organisms, *Cooling waters, Biological communities, Thermal pollution, Thermal stress, Heated water, Periphyton, Seasonal, Mathematical models, Statistical analysis, *Species diversity, *Diversity index, Oyster Creek Nuclear Generating Station, Forked River, New Jersey.

Periphyton diatom assemblages in the saline cooling water canal system of the Oyster Creek Nuclear Generating station were investigated for a twelve month period from December 1975 to December 1976. Uniform substrate samplers were placed in the intake canal water and the heated discharge canal water. These remained for 30 days before recovery to allow representative periphyton assemblages to develop. The structure and composition of the diatom assemblages in the two canals were compared. Thermal responses of indivudual taxa were difficult to identify; however, when the structure of the assemblages in the two canals were compared the effects of the thermally elevated effluent can be seen. In general, the assemblages in the heated effluent had fewer species, lower diversity indices, and greater redundancy. A degree of difference measure was used to show the differences between the assemblages at the two sites. Also, evidence is presentd that theermal stress above a critical temperature for short periods is detrimental to the structure of the assemblages. (Deal-EIS)
W80-02386

FACTORS INFLUENCING DISTRIBUTION OF MUSSELS IN THE BLANCO RIVER OF CENTRAL TEXAS,
Southwest Texas State Univ., San Marcos. Dept. of Biology.
F. R. Horne, and S. McIntosh.
The Nautilus, Vol 94, No 4, p 119-133, 1979. 1 Fig, 10 Tab, 37 Ref.

Descriptors: *Mussels, *Spatial distribution, *Rivers, Sewage effluents, Toxicity, Habitats, Water chemistry, Flow rate, Ammonia, Dissolved oxygen, Oxygen requirements, Animal metabolism, Nutrients, Benthic fauna, Texas, *Substrates, Water pollution effects.

Environmental parameters that influence the distribution of eight mussels in the Blanco River of Central Texas were studied. The effects of type of substrate, stream flow rate and physiochemical features on mussel distribution were evaluated, but emphasis was given to the role of organic enrichment of the river by a city sewage treatment plant. From tolerance tests to ammonia and low oxygen on five local mussels and from field studies, the following remarks can be made about mussel distribution in the Blanco River. (1) Low dissolved oxygen levels (0 - 0.5 mg O2/l) proved lethal to 47% of the mussels tested in seven days. (2) Levels of 5 mg NH+4 - NH3/l (pH 7.8 to 8.0; NH3 - N = 0.26 mg/l were lethal to 40% of the mussels tested in seven days. (3) Corbicula manilensis was more tolerant, and Amblema p. plicata less tolerant than the other mussels tested to elevated ammonia and low oxygen concentrations associated with sewage enrichment. (4) Even though the physiochemical parameters did not indicate stressful conditions on the days sampled, mussels of the Blanco River seemed to have been adversely effected by enrichment from the secondary sewage treatment plant of San Marcos. Fewer mussels were found downstream from the sewage plant than upstream, even where the river bottom, depth, and flow rates were similar. (Deal-EIS)
W80-02387

SPHAERIIDAE AS INDICATORS OF TROPHIC LAKE STAGES,
Smithsonian Institution, Washington, DC.
A. H. Clarke.
The Nautilus, Vol 94, No 4, p 178-184, 1979. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Bioindicators, *Trophic level, *Mollusks, Lakes, Oligotrophy, Mesotrophy, Eutrophication, Habitats, Spatial distribution, Dominant organisms, On-site-investigations, Arctic, *Sphaeriidae.

Analysis of field data associated with 35 species of boreal and arctic North American Sphaeriidae indicates interesting correlations between species occurrences and types of lentic habitats. A few species combine the attributes of stenotopy, broad geographical distribution, relative abundance and relative ease of taxonomic identification and appear to be of use as trophic lake stage indicators. These are: Pisidium conventus Clessin and Sphaerium nitidum Clessin for oligotrophic lakes, P. idahoense Roper and S. striatinum (Lamarek) for mesotrophic lakes, and P. rotundatum Prime and S. simile (Say) for eutrophic lakes. (Deal-EIS)
W80-02388

STUDIES ON THE TOXICITY OF RIVERS -I TOXICITY OF THE URAKAMI RIVER IN NAGASAKI CITY (IN JAPANESE),
Nagasaki Univ. (Japan). Faculty of Fiaheries.
For primary bibliographic entry see Field 5A.
W80-02389

LEAD IN SPOTTED WOLFISH, ANARHICHAS MINOR, NEAR A ZINC-LEAD MINE IN GREENLAND,
Copenhagen Univ. (Denmark). Inst. for Petrology.
For primary bibliographic entry see Field 5B.
W80-02394

MOLT-RELATED SENSITIVITY OF DAPHNIA PULEX IN TOXICITY TESTING,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 5A.
W80-02396

A DIRECT METHOD FOR STUDYING THE EFFECTS OF POLLUTANTS ON THE SEA BED,
For primary bibliographic entry see Field 5B.
W80-02398

5D. Waste Treatment Processes

SYSTEM FOR THE CLARIFICATION OF WASTE WATER AND UTILIZATION OF WASTE PRODUCTS,
A. H. Borst.
US Patent No 4,165,289, 29 p, 17 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 691-692, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water purification, *Water pollution treatment, Sludge treatment, Waste disposal, Incineration, Filtration, Equipment, Coals, Gases.

A solid and liquid waste disposal and treatment plant, and a method for operating the plant is described. Solid waste received in the plant is incinerated in one or more rotary drums placed in a closed furnace chamber. The solid waste incineration takes place under an oxygen deficiency to liberate heat energy and generate a combustible gas. A pyrolyzation or carbonization drum is also placed in the furnace chamber and heated with the liberated heat energy. Organic matter, primarily organic sewage sludge is placed into the pyrolyzation drum and carbonized to produce coal. The coal is placed into a two-stage coal filter for the filtration of incoming sewage. The second stage of the coal filter utilizes coal activated within the plant for the removal of both particulate and dissolved contaminants so that the effluent from the filter comprises usable water. The combustible gas is cracked in a cracking unit to form short chain hydrocarbons and the gas is utilized in an internal or external combustion engine, a furnace or liquefied for subsequent use. Hot exhaust gases generated in the furnace and in the combustion engine are cooled by directing it through suitable heat exchangers or over wet solid waste or wet, sludge saturated filter coal to dry them while cooling the exhaust gas to further cleanse the exhaust gas of pollutants for its discharge to the atmosphere. Sludge saturated filter coal is regenerated in the furnace by carbonizing organic sludge adhering to the filter coal or it may be incinerated with solid waste. (Sinha-OEIS)
W80-02011

PROCESS OF TREATING WASTE WATER FROM A TEXTILE VAT DYEING OPERATION TO PRODUCE A CONCENTRATE FOR REUSE,
Riegel Textile Corp., New York. (Assignee).
R. K. Teed, and E. A. Freeman, Jr.
US Patent No 4,165,288, 13 p, 6 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 691, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Dyes, Filtration, Reverse osmosis, Water reuse, Product recovery.

A process for treating waste water from a textile vat dyeing operation containing water, vat dyes, and dissolved and undissolved impurities including salts, lint, foreign matter, etc. to produce a concentrate suitable for direct reuse in the vat dyeing operation to conserve the use of dyes and water is described. Undissolved impurities of a predetermined particle size are filtered out. Thereafter, the waste water is concentrated and filtered down to a concentrate of a ratio of from about 30/1 to 200/1 while removing excess water and a substantial portion of the remaining impurities and retaining substantially all of the vat dyes and a desired amount of water. This concentrate is suitable for immediately using in the chemical feed tank and mixing into the dye mix of a conventional vat dye range without further treatment. The latter step is performed by circulating the waste water through a reverse osmosis filtration device, while separating the waste water into a permeate containing excess water and a substantial portion of the remaining impurities including salts and a concentrate containing substantially all of the vat dyes and a desired amount of water, and by removing the permeate and retaining the concentrate for reuse in the dyeing operation. (Sinha-OEIS)
W80-02018

APPARATUS FOR THE INTERMITTENT AERATION OF SEWAGE,
A. Schreiber, and S. Rudolph.
U.S. Patent No 4,165,286, 5 p, 4 Fig, 11 Ref, Official Gazette of the United States Patent Office, Vol 985, No 3, p 690, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Aeration, Equipment.

An apparatus for the intermittent aeration of sewage or sewage-activated sludge mixtures is placed below water level and consists of a horizontal air distributor in the form of a pipe jacket closed tightly at both ends except for an aperture for the air supply. The apparatus further includes an elastic air distributing foil covering the apertures for the passage of air and the upper portion of the pipe jacket. The foil is provided with air escape openings which are opened by the air supply to the pipe jacket and closed in case of interruption of the air supply by being sealed against the pipe jacket outside the area of the air passage openings. The apparatus further includes distancing strips located at the two opposite lateral longitudinal edges of the pipe jacket, below the openings for the passage of air and between the pipe jacket and the air distributor foil. (Sinha - OEIS)
W80-02028

COMBINED ANAEROBIC REACTOR AND SETTLER,
N.V. Centrale Suiker Maatschappij, Amsterdam (Netherlands). (Assignee).
E. Wind, and R. de Vletter.
U.S. Patent No 4,165,285, 8 p, 3 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 690, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Anaerobic conditions, Methane, Equipment.

The invention relates to an installation for anaerobic purification of waste or effuent water comprising particles which comprises a reactor, an after-settler device in the top part of the reactor which separates an upper settling zone from an anaerobic decomposition zone, and means are provided for using the developed methane gas as a transport aid of the particles and for separating the gas from the particles. (Sinha-OEIS)
W80-02029

MULTI-STAGE PURIFICATION SYSTEM,
Industrial Pollution Control Corp., Ludlow, MA. (Assignee).
R. E. Weber, and C. J. Zimmerman.
U.S. Patent No 4,165,283, 21 p, 21 Fig, 22 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 689, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water purification, Separation techniques, Flow, Filtration, Sedimentation, Equipment.

A multi-stage, single vessel system for removing contaminants from water is described. A contaminated liquid is fed into a deceleration chamber and decelerated. In this chamber the lighter solid particles rise to the top of the liquid where they are removed, while the heavier density particles settle downward. As the liquid moves downward from the deceleration chamber it essentially displaces liquid in the settling chamber upward into the filtering chamber. In so doing the change of direction of liquid movement also causes the heavier particles to settle downward. Concurrently the rising liquid in the filtering chamber passes through septums where sufficient quantities of remaining solid contaminates are removed to provide purified water ready for reuse or discharge. The solid contaminates are received by the explusion device which removes residue liquid and compacts the solid contaminantes. The deceleration chamber is within the central portion of the vessel and has flow control means. About and substantially coextensive with the deceleration chamber is a filtering chamber. Depending well into the filtering chamber are septums preferably coated with filter aid. Below the deceleration and filtering chambers is a settling chamber and beneath the vessel is an expulsion device. (Sinha - OEIS)
W80-02032

MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX I: PLAN FORMULATION.
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 055, Price codes: A06 in paper copy, A01 in microfiche. August 1973. 107 p, 3 Attachments.

Descriptors: *Waste water treatment, *Planning, *Waste water management, *Water management(Applied), *Plan formulation, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, Management, Alternative planning, Projections, Schedules, Administration, Coordination, Decision making, Governments, Institutions, Methodology, Regional development, Water resources, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

The purpose of this study is to address the problem of wastewater management in the Three Rivers Watershed Area and the Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. This appendix seeks to develop logically the process used in generating alternatives, analyzing these alternatives, and then selecting the best alternative for the solution of the problem. Various management systems were formulated by a three-step process: information gathering, systems design, and evaluation. Technical objectives are presented: to prevent the continued degradation of water resources, and to provide for the efficient reuse of treated wastewater and its separated constituents. Levels of effluent water quality are established and applied to certain reaches and circumstances. The study organization is capsulized, followed by a review of study procedure. The information gathering phase included the determination of flows and loads from principal pollution sources, identification of soils areas suitable for effluent land treatment, and background enviromental and institutional conditions. The systems design phase included the formulation of a spectrum of alternative wastewater management systems, designing their components, estimating their costs and evaluating, their environmental and institutional impacts. This phase ultimately resulted in the 12 alternatives displayed in this appendix's Attachment B. The evaluation phase consisted of the reformulation of three alternative plans, based on the 12 preliminary alternatives, the design of those plans, and the development of an implementation schedule for each. (Zayac-NC)
W80-02037

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, AP-

PENDIX III: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Haven and Emerson Ltd., Cleveland, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 150, Price codes: A04 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, Buffalo District, April 1972. 58 p, 9 Tab.

Descriptors: *Waste water treatment, *Rainfall-runoff relationships, *Stormwater, *Storm runoff, *Urban runoff, *Waste waTer management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Planning, Ohio, Waste water disposal, Waste water(Pollution), Municipal wastes, Municipal water, Sludge disposal, Domestic wastes, Cities, Surface runoff, Management, Costs, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. This specialty Appendix III describes the results of a study of water-based treatment of municipal wastewater and stormwater. The industrial waste treatment, land-based treatment and plan formulation are the subjects of other specialty appendices. This appendix consists of a Summary Report and three technical appendices. The Summary Report first discusses water quality goals, i.e., to establish a target for design of treatment processes for municipal wastewater, combined overflow and stormwater runoff. Two levels of treatment were established: Level 1, to reflect the proposed State Standards; and a higher Level 2, reflecting current technological limits. Design criteria and a methodology for developing alternatives are discussed in relation to both municipal wastewater and stormwater runoff. Cost estimation methodology and criteria are reviewed for unit costs and composite costs; procedures for estimating costs for preliminary and final alternatives are outlined. For the 12 preliminary alternatives, cost estimations and electrical power and chemical requirements are presented. These are also presented for the three final alternatives. The technical appendices contain the details of the work and rationale behind the selection of the basis of design and cost. (Zayac-NC)
W80-02039

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 154, Price codes: A07 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, Buffalo District August 1973. 127 p.

Descriptors: *Waste water treatment, *Institutions, *Watershed management, *Waste water management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, River basin development, Institutional constraints, Organizations, Planning, Administration, Administrative agencies, Management, Federal government, Local government, State governments, Evaluation, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, Cuyahoga and Rocky. Aproximately 23% of the area's 1500 square miles are urbanized. App VII is comprised of 6 parts. Part I summarizes qn initial survey of institutional arrangements and classifies wastewater service organizations by function. Relationships between organizations performing the same functions are explored: legal and administrative restrictions are summarized; future plans or organizations outlined; and financial aspects of the area addressed. Part II presents individual status reports on institutions in the study area. Federal government institutions with wastewater related responsibilities are discussed in Part III. Part IV is an institutional evaluation of financial and manpower factors in the study area, and is divided into three sections: institutions concerned with analytical purposes; financial arrangements among wastewater management institutions; and an analysis of manpower factors. Part V is an evaluation of institutional impacts of the 12 preliminary alternatives considered in the comprehensive planning process. Factors summarized for each alternative are financial, regional, resource re-use and land. Part VI presents an evaluation of the final three alternatives considered and discusses institutional arrangements which could be used in implementation. It contains: summary of impacts for each alternative; discussion of the impacts; alternative institutional arrangements for use in implementation; and institutional arrangements which are evaluated in terms of the extent to which they meet institutional criteria. (Zayac-NC)
W80-02040

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS. IX: AGRICULTURAL EVALUATION.
Ohio Agricultural Research and Development Center, Columbus.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 054, Price codes: A07 in paper copy, A01 in microfiche. Prepared for U.S. Army Corps of Engineers, Buffalo District, July 1973. 136 p.

Descriptors: *Agriculture, *Agronomy, *Rural areas, *Land management, *Land treatment, *Waste water management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, Social aspects, Environmental effects, Economic impact, Economic justification, Agricultural engineering, Agricultural watersheds, Agronomic crops, Farm management, Land classification, Crop production, Crop response, Soil management, Soil science, Fish management, Wildlife management, Economics, Irrigation, Evaluation, Chagrin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. Appendix IX considers the agricultural, environmental, social and economic impacts on the rural and farming communities involved in the study area. Consultant reports in each of five major areas--engineering, agronomics, fish and wildlife, economic and social--are evaluated. Engineering considerations discussed are drainage, irrigation, land management and hydrology. Under agronomic concerns, soil selection, crop selection and management, land disposal, soil renovation and sludge disposal are reviewed. Watershed management, enhancement of aquatic biota and lagoons and storage reservoirs are discussed under fish and wildlife considerations. Among the social and economic considerations reviewed are: economic and social dimensions; farm practices; market developments; land treatment; and water quality. The appendix then looks in depth at a land disposal alternative, its justification, implementation, description and impacts on rural life. Finally, land treatment projects for small and medium sized communities are outlined. Included here are agronomic aspects of evaluation and monitoring, engineering aspects of evaluation, designing wildlife benefits and community perception and acceptance. Conclusions indicate that land disposal is a viable alternative with proper management, but that effects of some of the proposed intensive land treatment are unacceptable. Community acceptance of land treatment is essential (Zayac-NC)
W80-02041

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE CLEVELAND-AKRON, THREE RIVERS WATERSHED AREA: TECHNICAL APPENDIX-PHASE I: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 833, Price codes: A08 in paper copy, A01 in microfiche. February 1973. 196 p, 9 Fig, 28 Tab, 5 Append.

Descriptors: *Waste water(Pollution), *Waste water disposal, *Waste water treatment, *Hydrograph analysis, *Storm runoff, *Urban runoff, *Agricultural runoff, *Waste water management, *Cleveland(OH), *Akron(OH), *Three Rivers Watershed(OH), Ohio, Reclaimed water, Sanitary engineering, Water policy, Water quality, Unit hydrographs, Surface runoff, Average runoff, Cities, Overland flow, Storm water, Urban hydrology, Rainfall runoff relationships, Runoff coefficient, Runoff forecasting, Land use, Water reuse, Chagarin River(OH), Cuyahoga River(OH), Rocky River(OH).

The Cleveland-Akron area was chosen by the Corps of Engineers as one of five pilot areas in which to develop a wastewater management program. This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. This volume covers Phase I of the study, and identifies the wastewater management problem with respect to municipal and stormwater runoff wastewater both as it exists today and is anticipated. It is in the nature of a progress report. Section One on municipal wastewater first studies the area's demography. These data are then used to assess present and expected land use patterns. Existing wastewater treatment plants are numerated and reviewed, followed by their values. Subdistricts within service areas are outlined and wastewater flows and loads, both present and future, are presented. The re-use potential of these wastewaters is assessed. Qualities of stream flow are reviewed; sediment deposits in the study area are then studied. Section Two deals with stormwater runoff. Drainage districts are outlined and rainfall is assessed as a base for determining drainage criteria. Runoff factors are developed and hydrographs presented. Both urban and rural stormwater runoffs are evaluated. The volume also contains appendices studying the design storm, drainage area characteristics and percent imperviousness, and hydrographs and loads. (Zayac-NC)
W80-02042

MUNICIPAL RECYCLING OF WASTEWATER,
Denver Research Inst., CO.
J. G. Milliken, and A. S. Trumbly.
American Water Works Association Journal, Vol 71, No 10, p 548-555, October 1979. 3 Fig, 4 Tab, 12 Ref.

Descriptors: *Waste water treatment, *Municipal water, *Water use, *Advanced waste treatment, *Water costs, *Health aspects, *Water supply, *Recycling, *Reclaimed water, *Recirculated water, *Waste water reclamation, Water resources, Potable water, Agricultural use, Industrial use, Groundwater recharge, Social aspects, Water reuse.

This article surveys and summarizes knowledge about renovating and directly recycling wastewater from industrial and municipal sewage for a variety of uses. Advanced Wastewater Treatment (AWT) processes have been developed to recycle wastewater into water usable for drinking, though such use is still quite controversial. Other methods of using water of lower quality include establishing dual distibution systems which establish a separate system for recycled water only; use of recycled water for industry to offset increasingly scarce fresh water supplies more appropriately used for drinking purposes; agricultural use of recycled water; exchange of wastewater return flows for fresh water destined for nonmunicipal use; and pumping treated wastewater effluent into groundwater aquifers, a method already used in the Los Angeles and New York metropolitan areas. In considering a wastewater recycling system, water

service costs must be expressed as the sum of collection, treatment, distribution and wastewater treatment costs to determine its feasibility for a particular area. When combined with inexppensive deep well water, the recycled wastewater can be used economically in a system and will offset large operation and maintenance costs. Health concerns about the use of such water and traditional lack of public acceptance of water re-use, particulaly for drinking, remain. Nevertheless, potable recycled water supplies may be feasible by 1995. (Arnold-NC)
W80-02044

METHOD AND UNIT FOR WASTEWATER TREATMENT BY MICROORGANISMS,
Niigata Engineering Co., Ltd., Tokyo (Japan). (Assignee).
K. Kuriyana, M. Sato, T. Matsuzaki, M. Honma, and S. Shida.
U.S. Patent No 4,165,281, 16 p, 12 Fig, 23 Tab, 8 Ref; Official Gazette of the United States Patent Office, Vol 985, No 3, p 689, August 21, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Organic wastes, Microorganisms, Aeration, Equipment, Oxidation.

A method and a unit for wastewater treatment with microorganisms is described, in which at least one non-woven fibrous mat having a three-dimensional network structure is disposed as a supporting media in an aeration tank. The microorganisms are retained on the surface of and in the interstices of the non-woven fibrous mat, and organic polluting matter in the wastewater is oxidatively decomposed by the microorganisms in the presence of oxygen. (Sinha-OEIS)
W80-02063

AUGER TYPE SCREENING DEVICE FOR REMOVING SEDIMENT AND THE LIKE FROM SOLUTIONS,
R. P. Briltz.
U.S. Patent No. 4,164,470, 8 p, 16 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 414, August 14, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Separation techniques, Flocculation, Sedimentation, Water purification, Equipment, Augers, Tube clarifiers.

The invention consists of a modular liquid treatment assembly comprising in combination, means to treat the liquid to induce formation of solids and at least one tube calrifier. The clarifier includes a casing, an inlet, a solids outlet and a liquid outlet. An auger assembly journalled for rotation within the casing urges the settled solids towards the solids outlet and the liquids pass from the casing through the liquid outlet. (Sinha-OEIS)
W80-02083

METHOD OF CLEANING PHENOL-CONTAINING WASTE WATERS,
Acieries Reunies de Burbach-Eich-Dudelange S.A., Luxembourg. (Assignee).
A. Wagner.
U.S. Patent No 4,164,469, 4 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 414, August 14, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Phenols, Adsorption, Separation techniques, Brown-coal coke.

A method of cleaning phenol-containing waste waters as derived from coke-producing, chemical and other industrial processes comprises treating the waste water, generally without any preconcentration of the phenol cntent thereof or other prior treatment, with a one-use adsorbent, namely, brown-coal coke. The brown-coal coke is then subjected at least in part to a thermal treatment which can be a coke producing process or combustion. (Sinha-OEIS)
W80-02089

LAND TREATMENT VS. AWT--HOW DO COSTS COMPARE,
Metcalf and Eddy, Sacramento, CA.
For primary bibliographic entry see Field 6C.
W80-02145

VACUUM-TYPE WATER REMOVAL SYSTEM FOR HOUSES, FACTORIES, SHIPS AND THE LIKE,
Electrolux, G.m.b.H., (Germany, F.R.). (Assignee).
H. R. Michael.
U.S. Patent No 4,164,049, 4 p, 2 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 985, No 2, p 275, August 14, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Domestic wastes, Waste disposal, Valves, Equipment, Vacuum systems.

A vacuum-type water removal system for buildings, factories, ships and the like is provided wherein waste water collection devices, such as sanitary facilities (e.g. toilets) and other waste producing/or collecting devices, are connected through a cut-off valve to a vacuum conduit for removal of the waste water. The invention concerns the provision of a supplemental arrangement including an overflow opening for the collection devices which is connected to a gravity feed line that feeds a collection chamber connected through a check valve to the vacuum line. (Sinha-OEIS)
W80-02148

INTERCHANGE OF METALS AND ORGANIC MATTER BETWEEN WATER AND SUBBITUMINOUS COAL OR LIGNITE UNDER SIMULATED COAL SLURRY PIPELINE CONDITIONS,
Missouri Univ.-Columbia. Dept. of Chemistry.
J. Godwin, and S. E. Manahan.
Environmental Science and Technology, Vol 13, No 9, p 1100-1104, September 1979. 6 Fig, 2 Tab, 9 Ref. OWRT A-110-MO(1), 14-34-0001-9027.

Descriptors: *Coal, Pipelines, *Slurry transport, Coal slurry pipelines, Humic acid, Metal transport, Metal solubilization, Atomic absorption analysis.

The uptake of metals and organic matter from granular subbituminous coal and lignite by water was investigated under simulated coal slurry pipeline conditions. The metals present at levels well over 1 ppm in both types of coal were Fe, Ca, Mg, Al, Na, K, Mn, Pb, Cu, Zn, Co, Ni, Cr, and Li. Of these, Pb, Co, Ni, and Cr were not detectable by flame atomic absorption in the slurry water separated from the coal. The percentage of metal extracted from the coal varied widely with the type of metal and with the coal/water ratio in the slurry, spanning a range of 0.01 to 75%. Humic acids were present at coal percentages below 5% and were shown to be involved in the solubilization of iron, copper, and aluminum.
W80-02151

POLAROGRAPHIC CHARACTERIZATION OF NITROHUMIC ACIDS PREPARED BY NITRIC ACID OXIDATION OF COAL,
Missouri Univ.-Columbia. Dept. of Chemistry.
J. B. Green, and S. E. Manahan.
Analytical Chemistry, Vol 51, No 8, p 1126 - 1129, July 1979. 4 Fig, 2 Tab, 24 Ref. OWRT B-115-MO(4), 14-34-0001-6095.

Descriptors: *Coal, Humic substances, *Humic acids, Polarography, Copper, Metal binding.

Humic acids prepared by the partial oxidation of bituminous coal with nitric acid have been analyzed polarographically. A major shift in the half-wave potential for the polarographic reduction of the nitro group at pH 5 indicated that the most probable neighboring group is phenolic -OH. Nitrobenzoic acids have pKa's that are too low to account for the observed effect. It is possible that the preparation of humic acid by the nitric acid oxidation of coal also introduces some nitroso groups, the presence of which cannot be determined with the methods employed in this study. Humate salts prepared from coal are of interest for pollutant removal because of their chelation, flocculation, acid neutralization, and acid gas sorption properties.
W80-02152

EVALUATION OF MOUND SYSTEMS FOR PURIFICATION OF SEPTIC TANK EFFLUENT,
Wisconsin Univ.-Madison. Dept. of Soil Science.
J. M. Harkin, C. J. Fitzgerald, C. P. Duffy, and D. G. Kroll.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122807, Price codes; A06 in paper copy, A01 in microfiche. Water Resources Center, University of Wisconsin Technical Report, 1979. 310 p, 26 Fig, 18 Tab, 112 Ref. OWRT B-099-WIS(1), 14-34-0001-7200.

Descriptors: *Septic tanks, *Domestic wastes, *Sewage bacteria, *Sewage disposal, *Sewage treatment, Soil disposal fields, Water pollution source, Coliforms, Streptococcus, Pseufomonas, Viruses, Nutrient removal, Public Health, Alternative septic systems, Mound systems, Environmental sanitation, Water purification.

Thirty-three mound systems for on-site disposal of septic tank effluent (STE) installed by commercial contractors in Wisconsin were surveyed and monitored for 2-3 years to test whether they are being properly designed, installed and operated and are achieving adequate wastewater purification. Every system examined was correctly sized and constructed but many systems were being dosed inappropriately with large volumes of STE. In these systems, bacteria and nutrients (N and P) from the STE penetrate deeper into the soil than in systems removed bacteria, viruses and phosphorus effectively and reduced the N load passing through the soil by nitrification-dentrification. No evidence of contamination by bacteria, N or P could be found in high groundwater near 4 systems located over permeable soils. The pressure system used for STE distribution in Wisconsin mounds prevents the formation of biological crusts where the STE enters the soil, a phenomenon which leads to failure of conventional systems. Three cases of mound system failure reported in the state were found to be due to faulty construction, not improper design or clogging. Wisconsin mound systems are expected to outlive and out perform conventional septic systems.
W80-02153

ENHANCED BIODEGRADATION OF HYDROCARBONS: ROLE OF BIOFLOCCULANTS AND BIOEMULSIFIERS,
Rhode Island Univ., Kingston.
S. M. Barnett, K. Kulkarni, C. W. Houston, and A. R. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-123664, Price codes: A03 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island Completion Report, September 1979. 40 p, 14 Fig, 1 Tab, 48 Ref. OWRT B-073-RI(1), 14-34-0001-7130.

Descriptors: *Biodegradation, *Organic compounds, *Hydrocarbons, Waste hydrocarbons, *Surfactants, Flocculation, Bioemulsifiers, Bioflocculants, Microorganisms.

Hydrocarbons are a major component of municipal and industrial waste streams. This study has concentrated on finding ways to enhance biological degradation of hydrocarbons. Surfactants were shown to promote the uptake of hydrocarbons by microorganisms. The beneficial effects of bioemulsifiers and bioflocculants were established and shown to be comparable with that of synthetic surfactants. Flocculation was found to play an important role. It aids hydrocarbon uptake and enhances cell growth, but when excessive, flocresistance to nutrient transfer becomes rate-controlling. With appropriate additions of bioemulsifiers, bioflocculants and synthetic surfactants, flocculation could be controlled and growth characteristics modified to take advantages of both growth rates and better dewatering.

W80-02157

VALUE OF WETLANDS AS DOMESTIC ECOSYSTEMS,
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 6B.
W80-02256

AQUATIC VEGETATION AND WATER POLLUTION CONTROL PUBLIC HEALTH IMPLICATIONS,
Texas State Dept. of Health, Austin.
R. Dinges.
American Journal of Public Health, Vol 68, No 12, p 1202-1205, December, 1978. 1 Fig, 3 Tab, 14 Ref.

Descriptors: *Rooted aquatic plants, *Waste water treatment, *Public health, Pollution, Water pollution treatment, Algae, Bacteria, Suspension, Wetlands, Texas.

Results obtained from pilot studies and the operation of a plant scale treatment facility located at the Williamson Creek Wastewater Treatment Plant at Austin, Texas, demonstrate that culture of the water hyacinth Eichhornia crassipes in shallow earthen basins is effective in the removal of algae, fecal coliform bacteria and deleterious impurities from wastewater stabilization pond effluent. Stabilization ponds followed by hyacinth culture constitute an economical, low energy treatment system which reduces significantly those potential health hazards associated with wastewaters. Harvested hyacinths represent a useful product which could be converted into compost, or used directly as a soil amendment. (Howard-Mass)
W80-02298

5E. Ultimate Disposal Of Wastes

SEWAGE SLUDGE TRANSPORT COSTS,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
For primary bibliographic entry see Field 6C.
W80-02007

SYSTEM FOR THE CLARIFICATION OF WASTE WATER AND UTILIZATION OF WASTE PRODUCTS,
For primary bibliographic entry see Field 5D.
W80-02011

WASTEWATER APPLICATIONS TO IRON-ORE OVERBURDEN MATERIAL IN NORTHEASTERN MINNESOTA: PROSPECTS FOR RENOVATION AND RECLAMATION,
Minnesota Univ., St. Paul. Dept. of Forest Resources.
K. N. Brooks, J. P. Borovsky, and A. C. Mace, Jr.
In: Utilization of Municipal Sewage Effluent and Sludge on Forest and Disturbed Land, p 407-422 1979. Editors, Sopper, W. E. and S. N. Kerr. Pennsylvania State University Press. OWRT B-102-MINN (2) 14-31-0001-5127.

Descriptors: *Waste water disposal, *Sprinkler irrigation, *Water reuse, Sewage effluents, Nutrients, Water analysis, Soil analysis, Vegetation, Growth rates, Evaluation, Minnesota, *Iron-ore overburden material, Water renovation, Mesabi iron range(MN).

Sprinkler irrigation of secondary sewage effluent on iron-ore overburden material was investigated to determine renovation effects as indicated by changes in soil percolate quality, and to evaluate possible ameliorative effects as indicated by changes in soil chemistry. A 20-year-old stripping dump with poor drainage characteristics and a newly deposited overburden site were studied. Over 99 percent of total P from the applied effluent was removed by the overburden as measured at 1.2m - depth. Renovation of nitrate plus nitrite -N was observed only at the poorly drained site. Changes in soil nutrients were not detected following one summer of irrigation. (Blake-Minn)
W80-02052

PHYSICAL AND CHEMICAL WATER QUALITY CHARACTERISTICS OF THE FOX CHAIN OF LAKES,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions of the Illinois State Academy of Science, Vol 71, No 3, p 239-259, November 1978. 7 Fig, 3 Tab, 13 Ref.

Descriptors: *Water quality, *Lakes, *Sampling, *Illinois, Data processing, Assessments, Physical properties, Chemical properties, Temperature, Water temperature, Dissolved oxygen, Turbidity, Suspended solids, Hydrogen ion concentration, Alkalinity, Hardness(Water), Nitrogen, Chlorides, Sulfates, Phosphorus, Iron, Silica, Dissolved solids, On-site investigations, Water pollution, Pollutants, Pollutant identification, *Fox Chain of Lakes(IL).

The Fox Chain of Lakes experiences luxuriant and prolonged algal blooms, periodic fish kills, offensive odors, and other symptoms of the advanced stage of eutrophication. All the deep lakes in the chain stratify thermally, and the hypolimnetic zones are totally devoid of oxygen. In the shallow lakes, even though the temperatures are uniform, or nearly so, for the entire depth, there is a significant drop in dissolved oxygen near the bottom of the lake. The oxygen demands exerted by the bottom sediments are much higher than the oxygen replenished from the atmosphere during the summer months. The lake waters are high in alkalinity and hardness, typical of midwestern surface waters. The pH values of lake surface water samples were never less than 8 during this investigation. This is indicative of active photosynthesis in which carbon dioxide is utilized from the bicarbonate alkalinity. Deep water samples had pH values less than 8 generally when the bottom sediments were undergoing anaerobic decomposition. The mean nitrate concentrations in all the lakes and at all depths examined were similar. The dissolved orthophosphorus concentrations in the deep water zones were observed to be several orders of magnitude higher than the values determined for surface and mid-depth water samples in these lakes. The phosphorus and nitrogen concentration levels in the lakes were much higher than the critical levels of nutrient concentrations suggested in the literature. (Sims-ISWS)
W80-02167

5F. Water Treatment and Quality Alteration

MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX I: PLAN FORMULATION.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02037

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX II: COMMENTS.
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 142, Price codes: A03 in paper copy, A01 in microfiche. August 1973. 43 p, 1 Fig, 1 Tab, 2 Attachments.

Descriptors: *Local governments, *Reviews, *State governments, *Waste water management, *Waste water treatment, *Costs, *Public participation, *Akron(OH), *Cleveland(OH), *Three Rivers Watershed(OH), Ohio, Instututions, Legal aspects, Social aspects, State jurisdiction, Agencies, Comments, Chargin River(OH), Cuyahoga River(OH), Rocky River(OH).

This report is part of a study undertaken to address the problem of wastewater management in the Three Rivers. Watershed and Cleveland-Akron Metropolitan Area. The study area consists of 3 river systems: the Chagrin, the Cuyahoga and the Rocky. Approximately 23% of the area's 1500 square miles are urbanized. Appendix II presents the views of interested governmental agencies in Ohio based on their review of the study's draft report. However, the total coordination between the District office of the Corps of Engineers and other interested governmental agencies is not documented. Presented are reviews received through two media: final public meetings and written responses. These responses include technical reviews by governmental agencies and statements concerning acceptability to Ohio citizens. Citizen responses obtained through workshop, and briefings are reported in Appendix VIII. The following governmental agencies provided written review of the draft report: Ohio EPA and Dept. of Natural Resources; Three Rivers Watershed District: Huron County Board of Commissioners; Huron County Dept. of Health; Summit County Sanitary Engineers; City of Akron; City of Olmstead Falls. The two attachments include comments by Ohio agencies and responds to comments by the City of Akron. (Zayac-NC)
W80-02038

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX III: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Haven and Emerson Ltd., Cleveland, OH.
For primary bibliographic entry see Field 5D.
W80-02039

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
For primary bibliographic entry see Field 5D.
W80-02040

BUILDING FOR THE FUTURE: A NEW GENERATION OF WATER TREATMENT PLANTS IN KANSAS,
Black and Veatch, Kansas City, MO.
J. H. Robinson.
American Water Works Association Journal, Vol 71, No 6, p 310-314, June 1979, 2 Ref.

Descriptors: *Water demand, *Water treatment, *Water treatment plants, *Kansas, *Topeka(KS), *Junction City(KS), *Leavenworth(KS), *Lawrence(KS), *Water softening, Water resources, Water quality, Domestic water, Water, Utilities, Water works, Water supply.

Descriptions of the emerging new generation water treatment facilities in four cities in Kansas are described: Topeka, Junction City, Lawrence and Leavenworth. In Topeka a 76-ML/day (20-mgd) addition to the existing water plant is being constructed. One unconventional design feature of the addition is the series arrangement of the presedimentation basins which will remove turbidity and suspended solids from source water more effectively and economically. The feasibility of a solar heating system for the filter building is also being investigated. The plant addition also includes the addition of a 48 inch raw line extension to an existing 36 inch line which will reduce head loss. In Leavenworth a new water treatment facility is to be built and will include an induced-draft aerator, a primary basin of the solids-contact type, a rapid-mix chamber, a secondary clarifier of the center flocculator type, three 7.6-ML/day (2-mgd) dual media filters and three 11-ML/day (3-mgd) vertical turbine high service pumping units. Junction City is building a new 38-ML/day (10-mgd) water softening plant to replace the existing treatment plant. The expansion program calls for five new 57-L/s (900 gpm) supply wells. Lawrence is constructing a new water treatment plant in anticipation of delivery of water from a new 2800-ha (7000 acre) reservoir at Clinton on the Wakarusa River. The new water supply will be of high quality, the principal treatment concern being taste and odor problems that may result from algae blooms. (Iervolino-NC)
W80-02048

DYNAMIC CONTROL OF THE COAGULATION PROCESS,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
P. J. Ossenbruggen, D. J. O'Brien, and W. J. Gallot.
American Society of Civil Engineers. Preprint 3560, Convention and Exposition, Boston, MA, April 2-6, 1979. 16 p, 6 Fig, 8 Ref. OWRT B-005-NH (1), 14-34-0001-9122.

Descriptors: *Coagulation, *Flocculation, *Water treatment, *Surface waters, *Color, *Turbidity, Water quality, *Water color removal, *Fulvic acid concentrations, *Water treatment plants, *Time series models.

Coagulation is a water treatment process utilized for removal of unwanted color and turbidity by chemical addition. It has been estimated that chemical costs associated with coagulation are at least $5 million per year for New England alone. Many water treatment plants in New England are small and do not have full time operators. Eighty out of 107 treatment plants in New Hampshire treat water for communities with populations of 10,000 people or less. The Community Water Supply Survey noted that two thirds of all water treatment plants operators have no formal training. For these and other reasons, overdosing of treatment chemicals in water treatment is felt to be widespread. This practice is very costly. The purpose of this paper is to describe the problems associated with the treatment of surface waters and to suggest a method to minimize the cost of treatment for small communities.
W80-02158

COMBINED ACTION OF POLYPHENOILS, QUINONES, REDUCERS AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
D. J. Stom, and O. M. Kozhova.
Polskie Archiwum Hydrobiologii, Vol 23, No 3, p 401-408, 1976. 6 Tab, 7 Ref.

Descriptors: *Aquatic plants, *Stream improvement, *Pulp wastes, *Toxicity, *Sulfur compounds, *Phenols, Rooted aquatic plants, Submerged plants, Chemical wastes, Industrial wastes, Water pollution effects, Water pollution treatment, Organic wastes.

Thiol derivatives were tested for their ability to weaken the toxic action of phenolic compounds and sulfur containing derivatives from pulp and paper industrial waste waters. The toxic action of p-benzoquinone and polyphenols, as pyrocatechol and hydroquinone, on Nitella and Elodea, is stipulated by the oxidation products. It is substantially weakened in the presence of thiols (cysteine, glutathione, ethyl-mercaptan) and natrium diethyl dithiocarbamate. These compounds did not influence the toxicity of resorcinol. Cysteine and oxidized glutathione did not prevent the action of p-benzoquinone and polyphenols. Addition of ethyl-mercaptan, cysteine, and ascorbic acid considerably increased the survival of Dunaliella in hydroquinone solutions. Presence of saccharose and natrium salt of adenosine triphosphoric acid did not influence the toxic action of p-benzoquinone and polyphenols on aquatic plants. (Steiner-Mass)
W80-02331

5G. Water Quality Control

SURVEY RESULTS ON THE BENEFITS OF WATER POLLUTION ABATEMENT IN THE MERRIMACK RIVER BASIN,
Yale Univ., New Haven, CT. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W80-02004

SAFE DRINKING WATER: CURRENT AND FUTURE PROBLEMS - PROCEEDINGS OF A NATIONAL CONFERENCE IN WASHINGTON, D.C.
For primary bibliographic entry see Field 6D.
W80-02027

MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX I: PLAN FORMULATION.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02037

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX II: COMMENTS.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5F.
W80-02038

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX III: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Haven and Emerson Ltd., Cleveland, OH.
For primary bibliographic entry see Field 5D.
W80-02039

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
For primary bibliographic entry see Field 5D.
W80-02040

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS. IX: AGRICULTURAL EVALUATION.
Ohio Agricultural Research and Development Center, Columbus.
For primary bibliographic entry see Field 5D.
W80-02041

WASTEWATER MANAGEMENT ALTERNATIVES FOR THE CLEVELAND-AKRON, THREE RIVERS WATERSHED AREA: TECHNICAL APPENDIX-PHASE I: MUNICIPAL WASTEWATER AND STORMWATER RUNOFF.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5D.
W80-02042

TREATMENT TECHNOLOGY TO MEET THE INTERIM PRIMARY DRINKING WATER REGULATIONS FOR ORGANICS: PART 4,
Environmental Monitoring and Support Lab., Cincinnati, OH. Physical and Chemical Methods Branch.
T. J. Sorg.
American Water Works Association Journal, Vol 71, No 8, p 454-466, August 1979.

Descriptors: *Mercury, *Chromium, *Drinking water, *Treatment, *Waste water treatment, *Pollutants, *National interim primary drinking water regulations, *Water pollution, *Chemical control, *Chemical wastes, *Toxic chemicals, Treatment methods, Conventional coagulation, Lime softening, Ion exchange, Activated carbon, Reverse osmosis, Electrodialysis, Water pollution sources, Toxicity, Public health.

The author describes current treatment methods for removing chromium and mercury from drinking water in order to meet the inorganic National Interim Primary Drinking Water Regulations. Chromium readily induces skin sensitizations and the hexavalent form produces lung tumors when inhaled, but the amount of chromium that can be ingested over a lifetime without producing adverse health affects is still virtually undetermined. Because chromium is utilized either directly or indirectly in many manufacturing processes, treatment techniques to remove or recover chromium from industrial wastewater have been well developed and documented. For the treatment of drinking water few studies have been reported because chromium has not been a serious problem. Various treatment methods are conventional coagulation, lime softening, ion exchange, activated carbon, reverse osmosis and electrodialysis. Mercury is a very toxic chemical and the chances of mercury occurig in drinking water have greatly increased over the last decade. Mercury occurs in inorganic and organic forms, both of which are toxic to humans. Mercury poisoning is characterized mainly by neurological symptoms and leads to permanent damage or death. The mercury treatment techniques studied most extensively have been conventional coagulation, lime softening and activated carbon. Ion exchange and reverse osmosis have also been investigated to a lesser degree. Presently, mercury is not a problem in drinking water although there are signs that the detection frequency is increasing. (Iervolino-NC)
W80-02043

EMISSIONS FROM IN SITU BURNING OF CRUDE OIL IN THE ARCTIC,
Tornoto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5C.
W80-02061

SALTWATER-BARRIER LINE IN FLORIDA: CONCEPTS, CONSIDERATIONS, AND SITE EXAMPLES,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. L. Hughes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-101306, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-75, 1979. 29 p, 26 Fig, 1 Tab, 32 Ref.

Descriptors: *Saline water intrusion, *Canals, *Groundwater, *Saline water barriers, *Water quality control, Florida, Coasts, Flow control, Dams, Gates, Streamflow, Channel improvement, Water table, Aquifers, Evaluation.

Construction of canals and enlargement of streams in Florida has been mostly to alleviate impact of floods and to drain wetlands for development. Land drainage and heavy pumpage from coastal water-table aquifers has degraded potable ground and surface water with saltwater. Control of saltwater intrusion is possible through implementation of certain hydrologic principles. State of Florida statute 373.033 provides for a saltwater-barrier line in areas of saltwater intrusion along canals. A saltwater-barrier line is defined as the allowable landward limit that a canal shall be constructed or enlarged or a stream deepened or enlarged without a salinity-control structure seaward of the saltwater-barrier line. The salinity control structure controls saltwater intrusion along a surface-water channel and assists in controlling saltwater intrusion into shallow aquifers. This report briefly reviews the fundamentals of saltwater intrusion in surface-water channels and associated coastal aquifers, describes the effects of established saltwater-barrier lines in Florida, and gives a history of the use and benefits of salinity-control structures. (Woodard-USGS).
W80-02237

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
For primary bibliographic entry see Field 6G.
W80-02327

MULTIPLE JETS IN SHALLOW FLOWING RECEIVING WATERS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02344

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPTIMAL ALLOCATION OF REGIONAL WATER RESOURCES,
Danish Inst. of Applied Hydraulics, Copenhagen.
T. Jonch-Clausen.
Nordic Hydrology, Vol 10, p 7-24, 1979. 8 Fig, 26 Ref.

Descriptors: *Optimization, *Planning, *Water resources development, *Methodology, Quadratic programming, Cachela Poudre River(CO), Colorado, Seasonal, Resource allocation, Model studies, Algorithms, Input-output analysis, Systems analysis, River basin development, Optimum development plans, Water supply, Water demand, Treatment facilities, Inter-basin transfers.

A methodology for regional water resources planning includes hydrologic as well as economic system inputs and has an iterative quadratic programming approach which handles larger-scale problems without overly complex mathematical techniques. The basic element of the methodology is a single-period, single-objective allocation model in which a nonlinear (concave) total cost function is minimized subject to a set of linear system constraints. An input-output framework brings the economic optimization together with the hydrologic context. The basic planning model is extended to include cost uncertainty and also deals with seasonal variations of water demand and supply in a dynamic framework. The methodology is applied to the Cache la Poudre River basin in Northern Colorado. Results show that presently available water supplies in the basin will be adequate in the year 2000, but by 2020, the water supply will be overextended requiring new transbasin water transfer projects. Regional sewage treatment facilities are also favored as increased economies of scale take hold. (Luedtke-Wisconsin)
W80-02006

BENEFITS OF POLLUTION CONTROL,
Bowdoin Coll., Brunswick, ME. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W80-02130

BENEFITS OF WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6B.
W80-02131

WATER RESOURCES OF THE PORT MADISON INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum, II.
Geological Survey Water-Resources Investigations 78-112 (open-file report), 1979. 73 p, 9 Fig, 1 Plate, 10 Tab, 16 Ref.

Descriptors: *Available water, *Groundwater resources, *Streams, *Water quality, * *Water supply, Indian +reservations, Streamflow, Aquifer characteristics, Water yield, Groundwater availability, Projections, Test wells, Saline water intrusion, Evaluation, Washington, *Port Madison Indian Reservation(Wash).

The study summarized in this report was made to provide Suquamish Tribal leaders with information on the reservation's surface- and ground-water resources. The Tribal leaders need this information to help manage and protect their water resources against over-development. The quantity of ground water estimated to be available for withdrawal on a long-term basis is about 600 million gallons per year in the western part of the reservation and 400 million gallons per year in the eastern part of the reservation. It should be possible, economically and practically, to capture at least 40 percent of this ground water with properly constructed and located wells before it is discharged into the sea. This is enough water to supply at least 5,000 and 3,500 people with domestic water in these respective areas--about four times the present population. Of nine stream sites that were studied, the lowest average streamflows for a 7-day period estimated to occur an average of once in 2 years were 1.3 cubic feet per second or less. Streams at three of the sites have been observed dry at least once. The short period of data collection during this study limits the accuracy of statistical estimates of low flows. Both surface and ground water are of good quality with no unusual or harmful constituents; there was no evidence of major pollution in 1977. In the future, seawater intrusion into the groundwater system and pollution of the surface water by improperly treated sewage waste water could become problems. (Woodard-USGS).
W80-02231

MODEL EVALUATION OF THE HYDROGEOLOGY OF THE CYPRESS CREEK WELL FIELD IN WEST-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. D. Ryder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-111081, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-79, October 1978. 68 p, 36 Fig, 3 Tab, 13 Ref.

Descriptors: *Hydrogeology, *Model studies, *Simulation analysis, *Potentiometric level, *Florida, Groundwater resources, Aquifer characteristics, Water wells, Water supply, Pumping, Groundwater movement, *Floridan aquifer, *Cypress Creek well field, West-central Florida.

The Cypress Creek well field is being developed to help supply a rapidly growing population in west-central Florida. The ground-water system in the Cypress Creek well-field area consists of a surficial sand aquifer, a semiconfining clay layer ranging from 2 to 25 feet in thickness, and a sequence of carbonate rocks, approximately 1,000 feet thick, called the Floridan aquifer. All recharge to the Floridan aquifer in the local area is derived from the overlying surficial sand aquifer by downward percolation through the semiconfining clay bed. The major proportion of water supplied to municipal wells open to the Floridan aquifer comes from a dolomitic section of the Avon Park Limestone containing two major cavernous zones. The hydrogeology of the well-field area was evaluated by digital model simulation. Model runs were made to analyze sensitivity of the model to variations in selected hydrologic parameters. The model was tested further by attempting to simulate the potentiometric surface of the Floridan aquifer under actual pumping stresses during the January 1976 dry period. (Woodard-USGS).
W80-02236

WETLAND DEVELOPMENT, AN ALTERNATIVE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. J. Kirby.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 139-142, 1978.

Descriptors: *Wetlands, *Developed waters, *Dredging, *Federal government, Administrative agencies, Water management(Applied), Water resources development, Aquatic plants, Ecological effects, On-site investigations, Preservation, Economics, Feasibility, Project planning.

The Dredged Material Research Program of the United States Army Engineer Waterways Experiment Station has demonstrated that wetlands development utilizing a suitable fill material, such as dredged material, as a substrate offers a solution to dredged material disposal and wetland losses that is feasible from a biological, engineering, and economic standpoint. Field studies around the United States have demonstrated that wetlands can be successfully developed, and these wetlands appear to function in the same manner as natural systems. Field implementation has begun on a small-scale, routine basis for either mitigation or aesthetic purposes. The information gained through this research effort is being used by state agencies to re-establish wetlands previously destroyed or filled. (See also W80-02253) (Howard-Mass)
W80-02277

6B. Evaluation Process

THE POTENTIAL OF ECONOMIC DESALINIZATION FOR SMALL SYSTEMS,
URS Corp., San Mateo, CA.
M. Staackmann, and F. J. Agardy.
Journal of American Water Works Association, Vol 69, No 7, p 344-347, July 1977. 3 Fig, 1 Ref.

Descriptors: *Cost-benefit analysis, *Hardness(water), *Desalination, *Southwest U.S., *Cities, Benefits, Costs, Desalination processes, Economics, Population, Water supply, Water costs, Water quality, Industries, Size, Dissolved solids, Salts, Economic justification, Economic feasibility.

Benefit-cost projections of small scale desalination plant use for improving marginal water quality supplies in western US states indicate that small populations cannot show benefit-cost advantage although medium population communities have favorable projections with a minimum level of industry. Large population communities have favorable benefit-cost ratios, except where existing water quality is marginally brackish, below 1000 mg/l TDS and 500 mg/l total hardness. The population range of investigated communities is 500-100,000. Only benefits which can be economically quantified such as use of household softeners, cleaning products, water heater life expectancy, and bottled water consumption, are included. By improving water supply, a major benefit (community) is the possibility of increasing its industrial base. Communities smaller than 700 population almost entirely fall out of feasibility projections. For communities with 700 population, with 3000 mg/l TDS and 750 mg/l hardness, a benefit-cost ratio advantage depends on the amount of industry. In communities with no industry, improving water quality is not economically justified. With light and medium industry, using 25% and 50% water use, respectively, benefit-cost ratios are favorable for a wide range of improved water quality, however, improving water with only 750 mg/l TDS is unfavorable regardless of industry makeup. (Danovich-Wisconsin)
W80-02001

THE ECONOMICS OF THE OCEANS: ENVIRONMENT, ISSUES, AND ECONOMIC ANALYSIS,
Columbia Univ., New York. Graduate School of Business.
M. Wilkinson.
The American Economic Review, Vol 69, No 2, p 251-255, 1979. 8 Ref.

Descriptors: *Economics, *Oceans, *Policy, *Resources development, *Management, *International waters, Fisheries, Gas, Oil, Shipping, Minerals, Evaluation, Extended economic zone, Exploitation, Cost-benefit analysis, Alternative planning, Coastal zone, Decision making.

The changing ocean environment, ocean policy issues, and certain areas of economic theory and measurement most relevant to ocean economics are reviewed. Almost all economic policy issues involve design of a regulatory mechanism to promote more rational management of ocean resources. Currently, the most serious policy issues in the extended economic zones concern fisheries, coastal zone management, and petroleum. Principal fisheries issues are: (1) formulation and analysis of bioeconomic mode of multispecies fisheries; (2) characteristics of supply functions for individual fisheries; (3) costs and benefits of regulating fisheries; and (4) the organization, structure, and political effectiveness of the fishing industry. Management problems in the petroleum and coastal zone

management include a lack of analysis of the allocative implication of alternative bidding schemes, the small number of private companies involved, and the proprietory nature of information regarding petroleum fields. Economic policy issues outside the extended economic zones are deep sea mining, shipping, pollution from ships, fishing for migratory species, and military uses. Usefulness of the theory of economic externalities or public commodities and the optimal control of natural resources as management tools is discussed. The shortage of empirical research reflecting a lack of biological knowledge means that policy decisions are resolved without estimates of the economic benefits and costs of alternative courses of action. (Luedtke-Wisconsin)
W80-02002

SURVEY RESULTS ON THE BENEFITS OF WATER POLLUTION ABATEMENT IN THE MERRIMACK RIVER BASIN,
Yale Univ., New Haven, CT. Dept. of Economics.
S. Oster.
Water Resources Research, Vol 13, No 6, p 882-884, December 1977. 3 Tab, 3 Ref, 1 Append.

Descriptors: *Cost benefit analysis, *Willingness-to-pay, *Surveys, *Water quality control, Costs, Benefits, Income, Financing, Cost-benefit ratio, Economic efficiency, Water use, Recreation, Pollution abatement, River basins, Merrimack River Basin(NHMA), New Hampshire, Massachusetts, Federal Water Pollution Control Act Amendments of 1972, Waste water treatment, PL 92-500, Industrial wastes, Municipal wastes.

Benefits of water quality improvement in the extremely polluted Merrimack River Basin are estimated from a frequency-of-use/willingness-to-pay survey of basin residents in 1973 in an attempt to determine whether economic benefits mandated by the Federal Water Pollution Control Act amendments of 1972 justify the cleanup costs. Data were collected from 200 residents on their willingness-to-pay, on their expected use of a clean river, and on certain socioeconomic attributes. Average willingness-to-pay for river quality improvement is slightly over $12.00 per year per person, and the median number of days respondents expect to use the clean river is 13 days per year. Both willingness-to-pay and frequency of use increases with income. Computing the annual cost of cleaning up the basin, assuming a lifetime of 20 years and a discount rate of 7%, per capita costs in most of the communities will be less than $12, indicating that aggregate benefits justify costs for the geographic area. However, this favorable cost-benefit ratio does not hold for all groups of the population since willingness-to-pay is influenced by income. If local cleanup costs are financed through a combination of user charges and property taxes as is now the case, the cost-benefit ratio for low income people may be less than 1, suggesting that financing techniques should better accomodate the relationship between benefits and income. (Luedtke-Wisconsin)
W80-02004

DEEP SEABED MINING AND DEVELOPING COUNTRIES: CONSIDERATION OF DISTRIBUTIONAL FACTORS,
United Nations Development Program, Rangoon (Burma).
M. J. Cruickshank.
Marine Technology Society Journal, Vol 13, No 2, p 5-9, 1979. 1 Tab, 11 Ref.

Descriptors: *Developing countries, *Governmental interrelations, *Manganese nodules, *International waters, *Distribution, *Deep sea mining, Economics, Economic impact, Governments, Metals, Pacific Ocean, Zaire, Political aspects, Water policy, Mineral industry, Mining, Optimization, Production, Profit, Benefits, Water pollution, Manganese, Copper, Cobalt, Nickel.

Major arguments for or against deep seabed mineral development are both unsubstantiated benefits accrue to both industrial and developing countries by early production, given an appropriate policy. Industrialized countries see nodule deposits as a source of strategic minerals presently in short supply domestically. Developing country producers of metals present in nodules think seabed production encroaches on their existing markets. However, strategic metal supplies for industrialized countries from ocean-based mines are militarily vulnerable in times of hostility; and the US payment surplus balance is not necessarily beneficial to world economy. However, at projected production rates, no individual market is substantially affected. For example, Zaire annually produces 500,000 tons of copper (Cu), 400,000 tons manganese ore (Mn), and 1,300 tons of cobalt (Co), representing 83%, 2%, and 5% of Zaire's exported production. If total seabed production is applied against Zaire's total exported production, 33,000 less tones of Cu, all Mn, and all Co exports would cease. This amounts to $100,000 million, or 3% of Gross Domestic Product; it does not significantly affect wealth distribution in Zaire, although it significantly affects their mine workers. Profit distribution from common heritage under existing regimes incurs no benefits to those most in need. Due to technical and environmental constraints, it is also unlikely that huge profits from seabed mining would accrue. (Danovich-Wisconsin)
W80-02010

BIOECONOMIC MODELS OF MARINE RECREATIONAL FISHING,
Rhode Island Univ., Kingston. Dept. of Resource Economics.
K. E. McConnell, and J. G. Sutinen.
Journal of Environmental Economics and Management, Vol 6, No 2, p 127-139, June 1979. 2 Fig, 1 Tab, 23 Ref.

Descriptors: *Optimization, *Sport fishing, *Marine fisheries, *Commercial fishing, *Fish management, *Mathematical models, *Recreation demand, *Social behavior, *Fisheries, Economics, Exploitation, Fish populations, Fish harvest, Fish, Equations, Competition, Curves, Social aspects, Management.

A bioeconomic model shows that marine sport fishing under open access results in too much fishing; unregulated ocean use by recreational fishers induces an economically inefficient allocation of resources. The 1970 recreational catch weighed 1.58 billion pounds; commercial finfish catch weighed 3.87 billion pounds. About 29% total weight of landed fish is recreational. An analytical model is developed which accounts for interdependence between present catch and future fish stock levels. In fisheries exploited by both commercial and recreational fishers under open access, the critical allocation parameter is the price elasticity of effort in each fishery. Recreationists fish primarily for fun rather than money. The model includes conditions for determining optimal recreational effort when recreational fishers supplement their income with their catch, when a small proportion of fishing population accounts for large catch proportion, and when catch rates differ from kill rates because anglers throw back a fraction of all fish caught. (Danovich-Wisconsin)
W80-02013

UTILIZATION OF ENVIRONMENTAL KNOWLEDGE FOR WATERSHED MANAGEMENT IN NORTHERN MICHIGAN,
Michigan Univ., Ann Arbor. Inst. for Social Research.
D. C. Pelz, and J. E. Gannon.
Environmental Management, Vol 3, No 2, p 113-121, 1979. 1 Fig, 10 Ref.

Descriptors: *Social aspects, *Public participation, *Water management(Applied), *Environmental management, *Lakes, *Water quality, *Watershed management, *Lake management, Michigan, Governments, Quantitative data, Qualitative data, Planning, Decision making, Wetlands, Aquatic impacts.

This report presents information gathered from a study conducted by the University of Michigan's Biological Station of the aquatic and human resources of the resort-oriented northern lower Michigan area. An area rich in water resources, this part of Michigan is beginning to feel the pressures of increasing population and resource use. The study attempted to differentiate between the gathering of 'hard' information (quantitative data) and 'soft' information (such as quality of life). Results were directed toward long-term environmental management. Research was conducted between 1972 and 1976 and included meetings with selected leadership groups, attendance at planning commission meetings and personal contacts. Information was disseminated in various ways, including a series of reports and 'information packages,' articles in local newspapers and reports over radio and TV. Illustrative examples are presented in which hard or soft information prepared by the Biological Station resulted in instrumental or conceptual use. These include a fish hatchery discharging into Crooked Lake; an ordinance to protect wetlands in Burt Township; planning for sewer systems in three lake areas; and freeway planning in one county. It is recognized that a longer time frame is needed for effective action by local groups in their approach to growth/resource management. Mutually reinforcing channels of communication should be employed to develop a climate of receptiveness and understanding to ensure environmentally sound decisions. (Arnold-NC)
W80-02022

SOME WATER RESOURCE POLICY CONSIDERATIONS,
Texas Univ. at Austin. Center for Research in Water Resources.
L. R. Beard.
Water Supply & Management, Vol 3, No 3, p 173-177, 1979.

Descriptors: *Water resource management, *Water policy, *Planning, *Economics, *Discount rates, *Multiple objective planning, *Value, *Rational formula, Investments, Project benefits, Assessments, Social values, Decision making, Project planning, Benefits.

The author questions water resource policy changes in the United States in relation to their impact on public welfare and on the democratic nature of the U.S. system of government. Multiple objective evaluations are seen to be unscientific and socially destructive when they fail to express the relative values of various objectives in terms of the general welfare. The author states that the use of unwarrantedly high discount factors for estimating the present values of future benefits strongly supports the type of project that is of transitory value and discourages the development and preservation of resources for the benefit of future generations. To avoid the pitfalls of multiple objectives concept, all project benefits need to be expressed in common terms in order to permit determination of an optimun management plan. Through this, multiple objective planning reverts properly to single objective planning and scientific methods can be applied to the solution of water resources management problems. Conclusions indicate that the most reasonable financial discount rate usable for planning is the difference between the interest rate in long-term government investments and the rate of inflation, which should be supplemented by discounts due to expected changes in technology and expected changes in social values. Proper implementation of a comprehensive economic system of values can expedite proper management of resources, greatly reduce costs and increase benefits and truly will build for the benefit of future generations as well as for the present. (Iervolino-NC)
W80-02026

SAFE DRINKING WATER: CURRENT AND FUTURE PROBLEMS - PROCEEDINGS OF A NATIONAL CONFERENCE IN WASHINGTON, D.C.
For primary bibliographic entry see Field 6D.
W80-02027

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: MAIN REPORT.
California Region Framework Study Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 169, Price codes: A13 in paper copy, A01 in microfiche.

Prepared for the Pacific Southwest Inter-Agency Committee, Water Resources Council, May 1972, 293 p, 23 Fig, 22 Tab, 15 Maps.

Descriptors: *Water resources development, *Resources development, *Multiple purpose projects, *Regional development, *Water resources, *California, *Oregon, *Planning, *Institutions, *Water supply, Economics, Navigation, Flood control, Recreation, Agriculture, Water quality, Fish management, Wildlife management, Environmental effects, Natural resources, Cost/benefit analysis, Social aspects, Administration.

This report, prepared under the guidance of the U.S. Water Resources Council, outlines alternative uses of water and related land resources for the California Region between 1965 and 2020. The area comprises all of California and 7% of Oregon and is divided into 11 subregions. Section A summarizes the findings of the 18 separate appendices of the study. By 2020 the area's population will be about triple that of 1965. The report considers a whole array of problems, including agricultural, industrial and domestic water supply; irrigation, drainage and electric power; flood control, water quality, watershed management and recreation. Regional characteristics and a study of the region's economy are presented. Although agriculture is still the dominating industry, the manufacturing and service industries are growing rapidly. Recommendations include the provision of regionwide flood damage and shoreline erosion management programs, more and better water quality management planning, and better intraregional coordination in planning. Section B describes the various economic needs of the region within the context of resource conservation and development, and presents a framework plan and an action plan to serve as a guide for the management, use and development of the region's water and related land resources. The action plan considers the goals of best use of resources and satisfying future needs and includes provisions for development of resources with minimal impact on the natural environment, continuation of major water supply development projects, use of geothermal energy, reduction of irrigation, shoreline development and protection measures. (Arnold-NC)
W80-02033

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX IX-FLOOD CONTROL.
California Region Framework Study Committee.
For primary bibliographic entry see Field 4A.
W80-02034

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVI-SHORELINE PROTECTION AND DEVELOPMENT.
California Region Framework Study Committee. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 170, Price codes: A12 in paper copy, A01 in microfiche. Prepared for Pacific Southwest Inter-Agency Committee, Water Resources Council, June 1971. 271 p, 5 Tab, 9 Maps, 3 Supplements, 30 Ref.

Descriptors: *Water resources development, *California, *Shores, *Beaches, *Coasts, *Shore protection, *Shore erosion, *Multiple purpose projects, *Oregon, Planning, Structural measures, Nonstructural measures, Land use, Recreation.

This appendix is part of a larger study undertaken to evaluate alternative water and related land resources for the California Region, an area consisting of California and 7% of Oregon. This appendix presents an evaluation and planning proposals for shoreline protection and development in the Region. A description of the region is presented. A regional summary of needs is followed by a more detailed analysis of shore-line data from the region's 11 subregions. The coastal shoreline of the area is generally a rugged, mountainous one, with a very temperate climate. Major land uses of the 1,349 mile shoreline are urban, agricultural, military, public reserves, and harbors. Owership is about 70% private; and 30% public. About 26% of the shoreline is critically eroding and requires further protection. Structural measures to protect the shoreline emphasize the urban and public recreation areas being threatened with critical erosion, and on the development of new sandy beaches. Proposed structural measures include seawalls, beach replenishment and stabilization. Non-structural measures include management programs for all public land and, by 2020, 70% of previously unmanaged private land. Estimated costs for these measures are approximately $187 million. Conclusions indicate that opportunities for recreation use of the shoreline--especially swimming--are too limited, and that substantial portions of the shoreline are subject to critical erosion. Recommended are replenishment of beach areas, beach stabilization, acquisition of sufficient rights-of-way to ensure access to public beaches, and more extensive data collection programs. (Arnold-NC)
W80-02035

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVII-NAVIGATION.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6D.
W80-02036

WASTEWATER MANAGEMENT STUDY FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX II: COMMENTS.
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 5F.
W80-02038

WASTEWATER, MANAGEMENT STUDY, FOR CLEVELAND-AKRON METROPOLITAN AND THREE RIVERS WATERSHED AREAS, APPENDIX VII: INSTITUTIONAL EVALUATION.
Linton and Co., Inc., Washington, DC.
For primary bibliographic entry see Field 5D.
W80-02040

BENEFITS OF POLLUTION CONTROL,
Bowdoin Coll., Brunswick, ME. Dept. of Economics.
A. M. Freeman, III.
In: Critical Review of Estimating Benefits of Air and Water Pollution Control, Report No EPA-600/5-78-014, p II-1-II-55 June 1978. 3 Fig, 19 Ref. 1 HA 094 68-01-2821.

Descriptors: *Pollution abatement, *Benefits, *Air pollution effects, *Water pollution control, *Methodology, *Alternative planning, Policy, Evaluation, Research priorities, Public health, Recreation, Analytical techniques, Measurement, Estimating, Economics, Water pollution effects, Cost-benefit analysis, Theoretical analysis.

Economic theory and analytical techniques for estimating national benefits of air and water pollution control are generally well-developed, except for health and life benefits, but empirical data is seriously deficient. Published estimates do not make adequate use of available analytical techniques and data, though the cost of using such resources would be relatively small. Recommendations are given for gathering additional data and for more effective use of existing data. For estimating health and property value benefits of air pollution control, both a consistent framework and language for expressing uncertainty in probabilistic terms exist. In the case of water pollution, however, medical knowledge of health benefits is inadequate, as is the data base for relating water quality changes to recreational use changes, and at present reasonable estimates of water pollution control benefits are not possible. Economists' efforts to assign values and estimate benefits in the areas of mortality, morbidity, and vegetation and materials damages from air pollution, and sport and commercial fisheries and production benefits from water pollution control must await better information on physical effects. The Lave and Seskin air pollution-mortality regression equations and the Freeman-Rosen property value estimating technique are recommended. (Lynch-Wisconsin)
W80-02130

BENEFITS OF WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.
J. B. Stevens.
In: Critical Review of Estimating Benefits of Air and Water Pollution Control, Report No EPA-600/5-78-014, p IV-1-IV-39, June 1978. 2 Fig, 22 Ref, 2 Append. 1 HA 094, 68-01-2821.

Descriptors: *Water pollution control, *Cost-benefit analysis, *Benefits, *Welfare(Economics), *Recreation demand, *Willingness to pay, Water pollution effects, Methodology, Model studies, Mathematical models, Public benefits, Monitoring, Environmental Protection Agency, Estimating, Option demand, Public health, Property values, Damage functions, Simulation analysis, Aesthetics, Policy, Planning, Economics, Attitudes, Social aspects, Recreation.

Very little precise knowledge exists of how much economic benefit would result from achieving state and federal water quality standards, despite the richness of literature on applied welfare-economics and benefit-cost analysis. Estimates of production losses (including waterborne disease) are adequate. But most potential benefits appear to be in the areas of recreation, aesthetics, and option demands, where methodologies for simulating consumers' willingness to pay for improvements are underdeveloped. Lack of adequate, generalizable behavioral relationships between water quality and consumer behavior is the predominant problem in assessing pollution control benefits. The U.S. Environmental Protection Agency should expand its role in generating studies of consumption benefits specifically designed to be extrapolated to the national level, and should establish a long-term behavioral monitoring system in which common socio-economic and physical data sets can be maintained at sites where water quality changes are occurring. Two recreational models are appended: (1) in which a recreationist has separate demand functions for two nonpriced sites having some degree of substitutability; and (2) in which the two recreation sites are considered by the recreationist as perfectly substitutable, but which have different travel costs. A reduction-in-travel-cost model may assist in assessing recreation benefits at a higher level of aggregation than is currently possible. (Lynch-Wisconsin)
W80-02131

SHOULD YOU BUY NOW. THE IMPACT OF INFLATION ON POLLUTION CONTROL EXPENDITURES,
De la Rue (Robert E.) Associates, Santa Clara, CA.
R. E. De la Rue.
Pollution Engineering, Vol 10, No 10, p 42-43, October 1978. 3 Tab.

Descriptors: *Costs, *Pollution abatement, *Inflation(economic), *Treatment facilities, Regulation, Economics, Waste water treatment, Cities, Water pollution, Water pollution control, Appropriation, Priorities, Federal government, Federal Water Pollution Control Act Amendments of 1972(PL 92-500), Legislation, Adjusted costs.

Although both government and industry have spent billions for air and water pollution control since the 1960's, additional capital expenditures exceeding $100 billion is needed to meet expanded goals; reasons for these large capital investments and future projections are stricter regulations and inflation. Inflation is expected to continue. Communities should, therefore, build the remaining municipal wastewater treatment plants as soon as possible. Delays will be costly, and many more municipalities will have difficulties raising their fund share, adding to the tax burden on citizens and industry, and increasing waste water treatment costs through high charges to users. Government inaction and delays, especially in the municipal wastewater treatment construction program, have been costly. The 1972 Water Pollution Control Act Amendments authorized $18 billion over fiscal

1973-1975, for wastewater treatment construction. Unfortunately, fund authorization does not mean appropriation or actual outlay. Municipal wastewater treatment construction grant program totals for 1957-1977 are $34 billion authorization, $26.9 billion appropriation, $25.3 billion obligation, and $12.9 billion outlay. Actual outlays total one-half obligations. The purchasing power of the dollar has decreased 31% since 1973; therefore, $18 billion authorization buys only $12.4 billion at 1978 costs. If $5 billion is authorized and actually obligated each year from 1978-1986, totaling $45 billion, the actual purchasing power at 5.5% inflation is only $36.7 billion. (Danovich-Wisconsin)
W80-02135

LEAK DETECTION: MODERN METHODS, COST, AND BENEFITS,
East Bay Municipal Utility District, Oakland, CA.
G. L. Laverty.
Journal American Water Works Association, Vol 71, No 2, p 61-64, 1979.

Descriptors: *Leakage, *Water conservation, *Utilities, *Water loss, *Oakland(CA), *Benefit-cost ratio, Water resources, Water supply, Water works, Public utilities, Costs, Benefits, Management, Pipes, Pipelines, Water districts, Water costs, Water conveyance, Water management(applied), Administration, Economics, Equipment, Electronic equipment, Surveys.

Leak location and repair programs conducted by the East Bay Municipal Utility District (EBMUD), Oakland, California, require slightly increased expenditures, but these are offset by resource savings. Savings from leak detection and repair programs will increase in the future, as electrical, chemical, and construction costs skyrocket while water resources dwindle. EBMUD's program involves two 2-person crews equipped with portable devices which detect sounds from a leak while filtering out most spurious noises. Program results are significant. A large leak, located and repaired on a 16-in pump line discharging water underground into a cracked ceramic storm drain, amounted to 0.36 L/s (60 gpm) in a high head pump zone with significant electrical energy loss. Over three years, the district reduced distribution system 'demand' caused by water losses by 2.5% which is over 6800 ML (1.8 bil gal)/yr. At an average 385 repairs/yr, EBMUD repaired $90,000 worth of leaks/yr, resulting solely from the survey program. Toilet tank and irrigation system leaks are the most common customer leak sources. Repaired customer leaks account for 25% of identified and repaired distribution leaks, an additional 4 ML (1 mil gal) per day. Program gross direct cost is $150,000/yr or 0.8% of the operations and maintenance budget. Specific benefits include conservation of aqueduct, filter plant, and pumping plant capacity; power and chemical savings; and water savings in drought years. (Danovich-Wisconsin)
W80-02136

A DO-IT-YOURSELF LEAK SURVEY BENEFIT-COST STUDY,
Los Angeles City Dept. of Water and Power, CA.
W. L. Kingston.
Journal of American Water Works Association, Vol 71, No 2, p 70-72, 1979. 3 Fig.

Descriptors: *Water works, *Surveys, *Cost-benefit ratio, *Los Angeles(CA), *Leakage, Water supply, Utilities, Public utilities, Economic justification, Economics, Water costs, Operating costs, Maintenance costs, Equipment, Electronic equipment, Pipes, Pipelines, Water loss, Water conservation.

During a major drought in California 1976-77, pipeline leaks in Los Angeles were surveyed as a conservation measure; program continuation is justified by economic and conservation data, using benefit-cost analysis. This benefit-cost analysis can help other water utilities determine whether a pipeline survey provides economic savings. The program consists of a two-person leak survey crew equipped with electronic sounding equipment. When a leak is found in the system, its exact position is determined and repair orders are written. If a leak is heard on private property, the customer is notified. Benefits include the value of water saved; deferred construction of new facilities; preventing property damage; refutation of claims and law suits; improved meter reading; improved public relations; savings in leak repair crew time due to accurate leak location; and postponement of time-of-day power charges in pumped service zones. Costs include leak repair, crew's labor, and equipment operation, maintenance, and depreciation. Water managers are the best judges of benefit-cost factors that apply to their particular system. (Danovich-Wisconsin)
W80-02137

THEORETICAL AND EMPIRICAL CONSIDERATIONS FOR ESTIMATING CAPACITY AND CAPACITY UTILIZATION IN COMMERCIAL FISHERIES,
Florida Agricultural Market Research Center, Gainesville.
F. J. Prochaska.
American Journal of Agricultural Economics, Vol 60, No 5, p 1020-1025, December 1978. 9 Ref.

Descriptors: *Commercial fishing, *Fish harvest, *Fish management, *Theoretical analysis, *Fishery Conservation and Management Act, Fisheries, Economics, Regulation, Legislation, Industries, Economic efficiency, Prices, Investment, Elasticity of demand, Production, Fish populations, Fish conservation, Fishing gear.

This paper addresses the theoretical construct of capacity, methodological problems in empirical measurement, and capacity measures used in some fishery management plans in response the 1976 Fishery Conservation and Management Act requirements. Capacity and capacity-utilization levels--with particular reference to developing fishery management plans--depend on input prices, physical productivity, and activities and constraints in the market and processing sectors which are transmitted to harvesting sectors through the pricing system. Capacity represents the physical output level that a firm or industry is capable of producing with existing plant and equipment; it is based on long-run considerations of expected prices and costs. The rate at which capacity is utilized, however, is more flexible and can be changed in response to short-run changes in price, costs and other conditions. The most important problems in capacity estimation are related to a lack of basic research and data, complexities of multiple-species fisheries, production seasonality, and unknowns in production, processing, and marketing under-utilized species. Several presently proposed plans such as the Northwest Atlantic Herring Fishery Plan, Gulf of Alaska Ground Fish Plan, and Northern Anchovy Fishery Plan are commendable since they consider economic factors throughout the system. (Danovich-Wisconsin)
W80-02141

GRAZING MANAGEMENT OF PLANT RESOURCES IN EASTERN SENEGAL AS INFLUENCED BY WATER DEVELOPMENT,
Texas A and M Univ., Vernon. Research and Extension Center.
P. W. Jacoby, Jr.
In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Resources, International Center for Arid and Semiarid Land Studies, Texas Tech University, Lubbock, p 655-660, July 1979, 5 Ref.

Descriptors: *Grazing, Management, *Carrying capacity, *Water resources development, *Range, Management, *Planning, Arid lands, Social aspects, Economic aspects, Administrative constraints, Institutions, Livestock, Vegetation, Senegal.

Grazing management in relation to water development in arid eastern Senegal is analyzed here as only a portion of a complicated project involving the socioeconomic, funding, development of infrastructures and numerous other problems of range and livestock improvement in the area near the confluence of the Senegal and Faleme Rivers. A division of the study area into eight management units based upon traditional use patterns and natural ecological boundaries on a best-fit basis with the information available, indicated that in order to achieve a sound basis of grazing consistent with the resources developed, a system of continuous moderate use for annual type vegetation will have the best chance of success for implementation. A balance between the forage and water resources based on annual rainfall rather than deep wells will help achieve the goal of balancing animal units with forage production. It is unfortunate that large water developments have resulted in overuse and abuse of the forage resources in many development projects in Africa, so that careful studies of local situations are necessary if technologies are to be chosen which have the best chance of adaptation. (Tickes-Arizona)
W80-02201

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

WETLAND VALUES,
Connecticut Coll., New London.
W. Niering.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 7-8, 1978. 6 Ref.

Descriptors: *Wetlands, *Value, *Land use, *Water resources development, Pollution, Productivity, Groundwater recharge, Flood protection, Sedimentation, Federal government.

The values of wetlands to man include pollution filtration, a potential for high productivity, ground water recharge, flood control, storm buffering, sediment accretion, and high levels of energy conservation. Incentives at the Federal level must be developed to assist states and local communities in wetland preservation. The multiple use role that wetlands serve in their natural state should be recognized. An inventory is necessary to aid in the preservation of the diversity of wetland types found in the United States. (See also W80-02253) (Howard-Mass).
W80-02255

VALUE OF WETLANDS AS DOMESTIC ECOSYSTEMS,
Florida Univ., Gainesville. Center for Wetlands.
H. T. Odum.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 9-18, 1978. 5 Fig, 7 Ref.

Descriptors: *Wetlands, *Value, *Ecosystems, *Evaluation, Energy, Waste water treatment, Groundwater recharge, Flood protection, Wildlife habitats, Ecosystems, Ecology, Water resources development.

Wetlands are natural water management and treatment systems that operate on solar energy and are self-maintaining. These systems can be used as interfaces with wastes of urban landscapes. Wetlands converge products of natural work from surrounding lands and thus are more valuable than many other lands. Value can be estimated from energies flowing or embodied in structure and services times a factor by which natural resources attract matching energy accompanied by dollar flow. The web of laws preventing a symbiotic coupling of wetlands and urban growth needs to be replaced with tax incentives for private developers to retain wetlands functions of importance to the public economy. (See also W80-02253) (Howard-Mass).
W80-02256

OVERVIEW OF MAJOR DEVELOPMENT IMPACTS ON WETLANDS,
Texas A and M Univ., College Station. Dept. of Oceanography.
R. M. Darnell.
In: Proceedings of the National Wetland Protec-

tion Symposium, June 6-8, 1977, Reston, Virginia, p 19-27, 1978. 2 Tab, 1 Ref.

Descriptors: *Wetlands, *Construction, *Environmental effects, Sedimentation, Wildlife habitats, Water resources development, Preservation, Suspended load, Ecology, Ecological effects.

The primary categories of environmental impact of construction activities in wetlands, in order of importance, include habitat modification and loss, increase in suspended sediments, bottom sedimentation, and modification of water flow regime. A need exists for a solid information base, synthesized into its critical elements and key processes, to provide the basis for informed action. The link between the environmental scientist and the environmental administrator must be strengthened to achieve the best, least cost solutions to the complex wetland protection problems facing the nation. (See also 80-02253) (Howard-Mass).
W80-02257

MINIMIZATION OF CONSTRUCTION IMPACTS ON WETLANDS: DREDGE AND FILL, DAMS, DIKES, AND CHANNELIZATION,
Texas A and M Univ., College Station. Dept. of Oceanography.
R. M. Darnell.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 29-36, 1978. 1 Ref.

Descriptors: *Wetlands, *Construction, *Environmental effects, Dredging, Dams, Channeling, Land fills, Ecological effects, Water resources development.

Environmental impact may be minimized at many levels: through the establishment of national priorities; passage of appropriate legislation; adoption and implementation of managerial guidelines; evaluation of preconstruction alternatives; on-site activities and post-construction recovery; and application of judicial process in the interpretation of environmental policy. General and operational principles of impact minimization are discussed along with specific recommendations for minimizing the impact of dredging and filling, damming, diking, and channelization activities. (See also W80-02253) (Howard-Mass).
W80-02258

WETLAND CLASSIFICATION IN WESTERN CANADA: A GUIDE TO MARSHES AND SHALLOW OPEN WATER WETLANDS IN THE GRASSLANDS AND PARKLANDS OF THE PRAIRIE PROVINCES,
Canadian Wildlife Service, Saskatoon(Saskatchewan).
J. B. Millar.
Availability: Information Canada, Ottawa K1A 0S9. Report Series Number 37, 1976. 38 p, 8 Fig, 6 Tab, 46 Ref, 3 Append.

Descriptors: *Wetlands, *Canada, *Classification, Marshes, Marsh plants, Vegetation, Rooted aquatic plants, Aquatic plants, Salinity, Waterfowl, Ponds, Water regime, Water levels, Grasslands.

Wetland vegetation is divided according to species composition or zones as follows: wet meadow, shallow marsh, emergent deep marsh, transitional open water, shallow open water, open alkali and disturbed. The first five zones form a gradient indicative of depth and duration of flooding. With one exception, basic wetland types are defined and named in terms of the vegetation zone which occupies the central or lowest portion of the depression. The proportion of the wetland occupied by the central vegetation zone, the density of emergent vegetation, at its center, the extent and reason for that density value and the pattern of vegetation zones all contribute additional information about the wetland's moisture regime and relative stability. Vegetation can also be used to interpret a wetland's salinity. Three physical features--size, basin depth and position on the watershed--are included in the classification system. The various criteria are intended to be used individually or in whatever combination are best suited to a particular project. (Stihler-Mass)
W80-02321

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SURVEY AND COMPARISON OF CALIFORNIA WATER AGENCIES-RATE STRUCTURE,
Otay Municipal Water District, Spring Valley, CA.
G. M. Reiter.
Journal of the American Water Works Association, Vol 69, No 7, p 356-363, July 1977.

Descriptors: *Water rates, *Pricing, *Water works, *Data collections, Water users, Water utilization, Water transfer, Water importing, California, Water conservation, Water demand, Utilities, Water supply, Surveys, Costs, Water distribution(applied).

An in depth survey of California water agencies pricing schedules suggests that price comparison between water utilities is virtually impossible due to the number of variables affecting each individual situation. Location of the agencies water supply, topography of the area, age of the facility, number of customers per hectare, type of consumer, size of the service area, the growth or development of the area, quality of the water supply, amount of water distributed, inflation and energy costs, fire protection facilities, and use of the general tax all enter into pricing structure decisions. A linear regression was used to determine if any correlation existed between the variables and water rates. No direct correlation was found. However, several distinct trends were noted. More agencies are beginning to abandon the traditional minimum charge with an allowable unit of water for this minimum, followed by a descending rate block. A service or capacity charge with a single commodity rate is becoming more common due to water conservation pressures. No-growth programs, charges for sewer service, and additional demand for engineering services are also more frequent considerations. (Luedtke-Wisconsin)
W80-02003

SEWAGE SLUDGE TRANSPORT COSTS,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
R. L. Christensen, and G. C. Reisner.
Compost Science and Land Utilization, Vol 20, No 1, p 32-34, 1979. 5 Tab.

Descriptors: *Costs, *Sewage disposal, *Transportation, Sludge disposal, Operating costs, Capital costs, Cost analysis, Landfills, Land spreading, Methodology, Waste disposal.

A methodology for estimating costs of transporting sewage sludge to landfill or farmland spreading disposal site alternatives is described. First, ownership and operating costs per hour are determined for the transportation equipment; a dump truck and tank truck in this illustration. Depreciation, interest on investment, insurance, taxes, fuel, oil, lubrication, and repairs are taken into account. Second, sludge handling was considered. Factors include: (1) the type of transportation used, which depends on the solids content of the sludge; (2) the volume of sludge; and (3) the distance traveled. Cost per ton is calculated by determining cost per load bringing together travel time, loading and unloading time, miscellaneous time, labor costs per hour, and ownership and operating costs per hour. Finally the cost data is converted to a solids basis. Results show that transport cost per dry ton decreases as solids content increases, and transport cost increases with distance. However, the cost increase per mile must be qualified by the level of solids content. (Luedtke-Wisconsin)
W80-02007

NATURAL RESOURCE POLICY: THE DISTRIBUTIONAL IMPACT ON CONSUMERS OF CHANGING OUTPUT PRICES,
Montana State Univ., Bozeman. Dept. of Agricultural Economics and Economics.
D. J. YoungDay, and R. D. Fight.
Land Economics, Vol 55, No 1, p 11-27, February 1979. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Natural resources, *Policy, *Prices, *Income distribution, *Economic impact, Production, Economics, Consumption, Input-output analysis, Social aspects, Regulation, Taxes, Pollution taxes(Charges), Equations, Mathematical models, Forestry, Construction materials, Lumber.

This paper develops a methodology for examining impacts on consumer purchasing power of changes in output prices stemming from widely ranging natural resource policies; the methodology is applied to timber resources and concludes that increases in forest product prices have a strongly regressive impact on income distribution. The methodology develops theoretical relations between policy and output prices and considers relations between these prices and consumer welfare. Production structure is represented by an input-output model. Natural resource policies affect prices in four principal ways: prices may be regulated, such as for natural gas and oil; policies may enhance or restrict natural supply of a resource, such as designating wildlife preservation areas; environmental policies may require additional inputs in resource extraction and processing, such as land reclamation by strip miners; and taxes may be levied on resources. Higher forest product prices may result from environmental regulation; taxing methods are likely to be regressive. It is assumed that existing housing prices respond significantly to new housing costs. Subsidizing forest products production in order to promote low housing prices with the intention to benefit low income classes, would be costly because it is not well targeted to this group. Application to forest products suggests that the approach outlined can be successfully applied to evaluating distributional impacts of resource policy changes. (Danovich-Wisconsin)
W80-02012

LABOR WAGE RATES, PRODUCTIVITY, AND THE COST OF WATER SUPPLY,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark.
American Water Works Association Journal, Vol 71, No 7, p 364-368, July 1979. 8 Fig, 4 Tab, 5 Ref.

Descriptors: *Operating costs, *Capital costs, *Water costs, *Cost analyses, *Cost comparisons, *Budgeting, *Water supply, *Annual costs, *Indirect costs, *Maintenance costs, Wages, Economics, Cost allocation, Fairfax County(VA), San Diego(CA), Labor costs, Water supply systems.

This article analyzes and summarizes the cost elements of water supply systems for two areas, Fairfax County, VA, and San Diego, CA, drawn from a larger U.S. Environmental Protection Agency study of 12 urban areas. The central thesis is that utility managers must look at elements other than capital facilities costs in attempting to minimize the overall cost of water supply. The system operating costs of both areas increased dramatically over the 1965-1974 study period, with Fairfax County increasing its OM cost as a percentage of total cost from 65 to 70%, and San Diego's increasing from 74 to 87%. Equations are presented which show that, over time, a utility's operating costs represent an increasingly larger share of its budget. Support services are the most rapidly increasing portion of operating costs, with labor cost increases being somewhat less significant. A regression equation relates cost to labor wages and indicates that annual operating cost increases almost linearly with respect to increases in revenue-producing water, if labor wage rates remain constant. Conclusions indicate that operating cost elements, particularly labor productivity, have been ignored in considering a utility's budget. Thus, utility managers are advised to think in terms of balanced capital investment designed to minimize total costs and not simply to minimize capital investment alone. (Arnold-NC)
W80-02047

WHAT COULD WATER REGULATIONS COST,
Southern Illinois Univ. at Carbondale.

E. E. Cook, L. Rogers, and J. H. Yopp.
Environmental Science and Technology, Vol 13, No 6, p 656-660, June 1979.

Descriptors: *Regulation, *Illinois, *Water quality standards, *Mercury, *Economic impact, *Toxicity, Costs, Water pollution control, Economics, Mathematical studies, Equations, Discharge(water), Effluents, Environmental effects, Industries, Waste water treatment, Benefits, Treatment facilities, Schools(Education).

Water pollution control costs are examined using Illinois mercury effluent standards as an example; increasing the mercury effluent standard from 0.5-3.0 micro g/l results in $136.3-153.8 million cost savings, 540-1890 job retention, and $5.5-29.5 million/y payroll. In November 1976, the Illinois Institute for Environmental Quality proposed the mercury effluent standard change. Since 1974, 170 dischargers violated the present 0.5 micro g/l mercury effluent standard and 33 exceeded the proposed 3.0 micro g/l standard. The adjusted mean mercury effluent concentration for five Illinois industries exceeds the present standard. Costs for all five industries are $28.9 million/y for mercury treatment. At the proposed standard, only one discharger must treat mercury at a $733,000/y cost, thus decreasing treatment costs 97.5%. At the 0.5 micro g/l standard treatment costs vary 0.04%-184% of respective industries' 1976 corporate net income. Five municipal sewage treatment plants exceed the present 0.5 micro g/l standard. Mercury treatment costs $134.6 million/y; at 3.0 micro g/l standard, treatment costs for the sole discharger would be $377,000/y, representing a 99.7% savings. Seven educational institutions violate the present mercury effluent standard. Mercury treatment costs $2.2 million/y and if the standard is relaxed to 3.0 micro g/l, two institutions would be obligated to treat mercury at a $724,000 cost, a 66-67% decrease. (Danovich-Wisconsin)
W80-02132

OPTIMAL POLLUTION IN THE PRESENCE OF ADJUSTMENT COSTS,
Newcastle upon Tyne Univ. (England). Dept. of Economics.
B. Beavis.
Journal of Environmental Economics and Management, Vol 6, No 1, p 1-10, 1979. 3 Fig, 6 Ref.

Descriptors: *Optimization, *Costs, *Adjusted costs, *Mathematical models, *Path of pollutants, Water pollution control, Equations, Time, Discharge(water), Effluents, Water pollution, Damages, Pollutants, Pollution taxes(charges), Biodegradation, Pollution abatement, Flow, Discount rates.

Industry is faced with adjustment costs when changing their pollution discharge levels from production; even if long run optimum stock of pollution is below initial levels, adjustment costs imply an optimally increasing stock of pollution in the short run. An extended Harford model takes into account persistent and degradable pollutants whose environmental effects entail stock-flow relationships. General appropriate steady-state equilibrium conditions and specific optimal time paths for relevant variables are derived. Consideration is also given to fiscal implications resulting from adjustment costs. Marginal costs of particular abatement levels depend on how rapidly levels are changing. However, a unique value for marginal abatement costs can be determined independently of abatement change rates. Both these possibilities are compared with similar models. Along optimal paths, abatement flow and stock of pollution converge asymptotically to their equilibrium levels. If ecological equilibrium doesn't initially exist, it is optimal to allow pollution to increase for sometime, even though it exceeds equilibrium levels, and resulting damages are considerable. In these situations, environmental benefits occur only after a considerable time lapse. Where damages depend on flow of abatement, adjusted costs are present, and constant marginal damages are imposed, appropriate polluting taxes are also constant and equal to the constant marginal damages level. (Danovich-Wisconsin)
W80-02133

COST OF WATER SUPPLY: SELECTED CASE STUDIES,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
R. M. Clark, J. A. Machisko, and R. G. Stevie.
Journal of the Environmental Engineering Division, ASCE Vol 105, No 1, p 89-100, February 1979. 3 Fig, 8 Tab, 10 Ref, 2 Append.

Descriptors: *Water supply, *Costs, *Water costs, Potable water, Water quality, Water works, Safe Drinking Water Act, Public utilities, Utilities, Capital costs, Operating costs, Maintenance costs, Mathematical models, Equations, Depreciation, Projections, Forecasting.

Water rates during 1964-1974 from 12 water utilities across the U.S. show general increases in demand for revenue-producing water, labor wage rates, and other operating and capital expenses associated with water supply. Total production water costs will increase by 59% ($11.6-18-5 million/yr) between 1975-1980 due to normal demand and inflationary pressures. With the most expensive technology, granular activated carbon (with separate contractors), total production water costs will increase by another 22% to $22.6 million/yr. This study, prompted by the 1974 Safe Drinking Water Act, presents data from selected water utilities including at least one class A utility (revenues greater than $500,000/yr) in each of 10 EPA regions. Average total expenditures increased 108% over the 10-year period, but unit costs increased only 52%. Average revenue-producing water has continually increased, from 23 billion gallons (87 million cu m/yr) in 1964, to 32 billion gallons (120 million cu m/yr) in 1974, a 13% increase. Operating costs increased 127%; capital costs increased 78%. Energy costs went up nearly exponentially and increased faster than chemical costs. The ratio of operating costs to annual depreciation has continually increased. Mathematical models relating annual operating cost to labor wage rate, labor productivity, and revenue-producing water and relating capital cost to unit depreciation and revenue-producing water are also developed. (Danovich-Wisconsin)
W80-02134

SHOULD YOU BUY NOW. THE IMPACT OF INFLATION ON POLLUTION CONTROL EXPENDITURES,
De la Rue (Robert E.) Associates, Santa Clara, CA.
For primary bibliographic entry see Field 6B.
W80-02135

LOW COST, LABOR INTENSIVE COASTAL DEVELOPMENT APPROPRIATE TECHNOLOGY,
M. Porraz, and R. Medina.
Sea Technology, Vol 18, No 8, p 19-24, August 1977.

Descriptors: *Developing countries, *Technology, *Coastal structures, *Beach erosion, *Coastal zone management, Labor, Labor supply, Capital, Costs, Coasts, Erosion, Erosion control, Construction, Economics, Breakwaters, Mexico, Construction materials, Riprap, Roadbanks.

An alternative solution for solving river and sea erosion control problems in developing countries calls for using materials readily available in the region, low cost equipment, tools which are easy to acquire and transport and do not require costly infrastructure, and employment of local unskilled labor. Operational Designs Systems (ODS) technology was intensively researched in Mexico for more than seven years and relies on latest developments in materials technology combined with marine and hydraulic engineering concepts and procedures. Main project aims were to develop simple and practical systems. Using a small portable pump, artificial synthetic textile containers are filled with a sand-water mixture and solid but flexible 3-30 ton blocks are obtained. A more permanent solution utilizes flexible, textile impervious forms of predetermined shape which allow building big concrete blocks on the exact project site; they are used for breakwaters, jetties, revetments, and groins. Another ODS element consists of flexible, synthetic textile forms which are also filled at the site with a water-sand-cement mixture to form concrete mats. These are suited for irrigation channels, riverbanks, and road embankment revetments. Structures in Mexico, Venezuela, and Kuwait behave satisfactorily and resist extreme oceanic conditions. Required building time is also less than with more conventional methods and systems allow work interruption without increasing total investment. (Danovich-Wisconsin)
W80-02142

THE BACKWARD INCIDENCE OF POLLUTION CONTROL-SOME COMPARATIVE STATICS IN GENERAL EQUILIBRIUM,
Wesleyan Univ., Middletown, CT. Dept. of Economics.
G. W. Yohe.
Journal of Environmental Economics and Management, Vol 6, No 3, p 187-198, 1979. 2 Fig, 10 Ref.

Descriptors: *Economics, *Water pollution control, *Elasticity of demand, *Regulation, Pollution abatement, Production, Mathematical models, Mathematical studies, Equations, Effluents, Employment, Labor, Capital, Water quality standards, Equilibrium, Income.

Depending upon particular circumstances, the cost burden of increasingly stringent pollution controls may be shifted forward on customers of polluting products, or backwards to various production factors; this paper addresses impacts of more restrictive pollution control on relative income shares of production factors. Incidence direction depends upon the relative factor intensity of the nonpollution sector, and its magnitude depends upon relative price elasticities in both pollution and nonpolluting sectors. The general equilibrium model consists of a simple full-employment economy that is divided into polluting and nonpolluting sectors. If governments accompany stricter controls with public relations campaigns aimed at reducing consumption of polluting sector's products, price elasticity of demand in pollution sectors would be lowered in the long run. Polluting sector contraction would therefore be exaggerated, and the incidence, in either direction would be more severe. However, such a campaign reduces possibilities of the reversed incidence case with its incumbent difficulties in achieving lower pollution levels. Contracting the polluting sector causes some short-run unemployment which persists until long run adjustments are completed. If research programs improve pollution cleansing technology and if pollution is easier to remove from industrial effluent, smaller adjustments would be made. Similar effects are noted if training programs and production research allow capital and labor to substitute more easily for one another. (Danovich-Wisconsin)
W80-02143

A DETERMINATION OF THE OPTIMAL PRICE OF UNDEPLETABLE EXTERNALITIES,
Energy Information Administration, Washington, DC. Office of Energy Source Analysis.
N. D. Uri.
Journal of Environmental Management, Vol 8, No 2, p 95-104, March 1979, 7 Ref.

Descriptors: *Economics, *Optimization, *Competition, *Equilibrium prices, *Pricing, *Externalities, Equations, *Water pollution control, Air pollution, Taxes, Environmental control, Mathematical studies, Social aspects, Welfare(Economics), Clean Air Act, Pollution abatement.

A satisficing approach is used to determine the fee for achieving a given level of undepletable externality. Policy implications from similar studies show that to meet a given ambient standard at minimum costs, different emission fees should be imposed on each firm. A competitive Negishi-type model is used in this investigation. Competitive equilibrium is the maximum point of a social welfare function. With a satisficing approach, the most efficient method of obtaining an ex-ante selected emission level is sought, and, consequently, the resulting solution is second best. To find a quasi-optimal

pareto solution, social welfare is maximized, subject to requirements that no consequent loss occurs to any other individual and that constraints constituted by production functions and resource availability are satisfied. The solution gives two results. If an iterative emission fee achieves emission standards, the solution is quasi-optimal Pareto, in the sense that customers have maximized their utility for given emission levels. Appropriate emission fees equal either of two equations given in the paper. As a practical matter, quasi-optimal fees are not compatible with current water pollution legislation but are compatible with the Clean Air Act. For air pollution control, implementation is both administratively and legally defensible. (Danovich-Wisconsin)
W80-02144

LAND TREATMENT VS. AWT--HOW DO COSTS COMPARE,
Metcalf and Eddy, Sacramento, CA.
R. W. Crites, M. J. Dean, and H. L. Selznick.
Water and Wastes Engineering, Vol 16, No 9, p 51-53, September 1979. 4 Fig.

Descriptors: *Costs, *Waste water treatment, *Land, *Tertiary treatment, Curves, Waste treatment, Flow, Economics, Land use, Land appraisals, Sewage, Capital costs, Operating costs, Maintenance costs, Economic efficiency, Sewerage, Warren(MI), Muskegon(MI).

Land treatment systems are less expensive than advanced wastewater treatment (AWT) systems for 0.5-50 mgd flow ranges when new treatment facilities must be built, based on $4,000/acre laand prices. However, land treatment remains more capital-intensive and land cost is still a significant percentage of capital and total costs. Some cost components are site-specific. Curves are based on typical unit costs and assumptions; they do not account for local variations such as land prices, type of pre-application treatment, energy prices, storage times and force main distance. Land prices account for as much as 57% (for slow rate systems) of land treatment total costs whereas for AWT, land is seldom more than 1% total cost. Land treatment and AWT systems are compared in two, similar-sized, Michigan cities. The Muskegon system is a slow rate system (sprinkler irrigation) while Warren has a nitrification (but not denitrification) and phosphorus removal plant. In Muskegon, most flow is industrialwhile in Warren, most flow is domestic. Average flows and design capacities are similar. The Muskegon facility has slightly lower overall gross costs, but is more capital-intensive than the Warren facility. Capital investments are actually about the same, but O&M costs at Warren (24.6 cents/1,000 gal) are much higher than at Muskegon (7.1 cents/1,000 gal). (Danovich-Wisconsin)
W80-02145

STREAM CHANNELIZATION (P.L. 83-566) INCREASED WETLAND LOSSES IN THE DAKOTAS,
Fish and Wildlife Service, Bismark, ND.
For primary bibliographic entry see Field 6E.
W80-02300

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3E.
W80-02354

6D. Water Demand

CHANGING PATTERNS OF OUTDOOR RECREATION PARTICIPATION IN NORTHEASTERN UNITED STATES,
Vermont Univ., Burlington.
M. I. Bevins, T. L. Brown, G. L. Cole, K. J. Hock, and M. W. Kottke.
Delaware Agricultural Experimental Station Bulletin, No 427, April 1979, 80 p, 7 Fig, 29 Tab, 10 Ref, 4 Append.

Descriptors: *Recreation demand, *Market research, *Surveys, *Northeast US, *Use rates, *Social participation, *Data collections, Recreation, Travel, Jogging, Canoeing, Snowmobiling, Camping, Tennis, Bicycling, Picnicking, Ice skating, Fishing, Sailing, Boating, Hiking, Hunting, Swimming, Motorcycling, Backpacking, Golf.

The extent to which substitutions and other changes in outdoor recreation are taking place and how they relate to changing socioeconomic conditions were studied as part of an outdoor recreation market research program in the northeastern states. Significant changes occurring in 22 outdoor recreation participation patterns were surveyed with a telephone interview of 3900 adults in a 13-state area in 1977. Eighty-five percent of those surveyed participated in at least one of the 22 activities; 42% adopted new activities with 44% increasing and 64% decreasing participation in at least one activity and 61% of these indicating a variation in place of participation, all in a two-year period. Cross-Country skiing, jogging, canoeing, snowmobiling, recreation vehicle camping and tennis were high growth activities. Bicycling, picnicking, and ice skating were the only activities not having increased demand. Sailing, motor boating, backpacking, tenting, freshwater and saltwater fishing, golfing, hiking, hunting, motorcycling, downhill skiing, water skiing, and swimming were the other activities considered. Net gain in travel occurred for 17 of the 22 activities and was substantial for such 'energy efficient' activities as backpacking, tenting, and hiking. The need for better trend indicators and monitors of chaning markets is recommended to permit more efficient planning of public and private investments in recreation land use. (Luedtke-Wisconsin)
W80-02008

AN ANALYSIS OF RESIDENTIAL DEMAND FOR WATER USING MICRO TIME-SERIES DATA,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
L. E. Danielson.
Water Resources Research, Vol 15, No 4, p 763-767, August 1979. 3 Tab, 24 Ref.

Descriptors: *Water demand, *Prices, *Time series analysis, *Domestic water, *Raleigh(NC), *North Carolina, Consumptive use, Potable water, Economics, Economic impact, Seasonal, Temperature, Rainfall, Equations, Sprinkler irrigation, Surveys, Lawns, Meter readings, Elasticity of demand.

Water demand analysis using monthly cross-section and time series meter readings from 261 residential households in Raleigh, North Carolina, May 1969-December 1974 generally shows that sprinkling demand is highly responsive to water price, while in-house or winter demand is less responsive. Variables used in calculating residential demand include rainfall, average temperature, water price, house value, lot size, and household size. Water price rose during the sampling period from $0.7019 to $1.1611 per 1000 gallons, first block price. Average daily water consumption is 205.9 gal/household/day. Average household size is 3.07 persons and average appraised house value is $18,376. Price elasticity is -0.27. Household size consistently explains water demand more than any other variable; an increase in household size from three to four (33%) increases water use 24% or over 50 gal/household/day. Sprinkling demand for each customer is estimated by subtracting winter (November-April) use from summer (May-October) use, assumig that winter use equals summer in-house use. Water sprinkling use averages 27 gal/household/day. Sprinkling water price elasticity is -1.38, considerably more elastic than winter or total residential demand. A 10% price increase is associated with a 13.8% decreases in sprinkling demand, or 3.75 gal/household/day. (Danovich-Wisconsin)
W80-02009

SAFE DRINKING WATER: CURRENT AND FUTURE PROBLEMS - PROCEEDINGS OF A NATIONAL CONFERENCE IN WASHINGTON, D.C.
Reseach Paper R-12. Resource for the Future, Washington, DC, 1978. Russell, C. S., editor. 641 p.

Descriptors: *Water quality, *Water quality control, *Potable water, *Drinking water, *Safe Drinking Water Act, *Water quality standards, *Legislation, Governments, Water pollution, Epidemiology, Financing, Water purification, Wastewater, Environmental sanitation, Pollutants, Water treatment facilities, Water utilization, Public health, Carcinogenic effects, Toxins, Health effects, Municipal systems.

This is a collection of papers presented at proceedings concerned with the U.S. Environmental Projection Agency's (EPA) setting of standards called for in the Federal 1974 Safe Drinking Water Act. The technical background concerning safe drinking water is presented, with discussions of the European and British experiences; costs and financing of compliance with the Act are discussed; and specific problems are identified and discussed. Problems lie with the capability of local governments to set proper safe drinking water standards and develop a rationale that follows a uniform and consistent approach to standard setting. The absence of such a rationale is asserted to have produced economic and health inequalities for the public. Data indicate that known carcinogens such as vinyl chloride and suspected carcinogens such as benzene, dieldrin, PCB, kepone, and aldrin have been carefully measured in sampled water, and drinking standards must address these substances thoroughly. Recommended are that federal and state governments remove impediments to local financing of better engineered drinking water systems. More data are also needed on the costs/benefits of home filters. Local governments may have difficulty meeting the new Safe Water Drinking Standards without adequate federal/state funding. Proposed policy options recommended for local government compliance with the Act include changing the locality's raw water source, installation of a dual-or triple-distribution system, furnishing bottled water to some areas, and the EPA proposal to use granular activated carbon for controlling synthetic organics in the water supply. (Arnold-NC)
W80-02027

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVII-NAVIGATION.
California Region Framework Study Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 171, Price codes: A12 in paper copy, A01 in microfiche. Prepared for Pacific Southwest Inter-Agency Committee, Water Resources Council, June 1971. 267 p, 42 Tab, 11 Maps, 1 Drawing, 3 Supplements, 53 Ref.

Descriptors: *Water resources development, *California, *Navigation, *Harbors, *Multiple purpose projects, *Navigable waters, *Water resource planning, *Oregon, Planning, Recreation, Boating, Costs.

This appendix is part of a larger study undertaken to evaluate alternative water and related land resources for the California Region, an area consisting of California and 7% of Oregon. This appendix presents an evaluation of the future needs for commercial and recreational navigation facilities in the Region. A regional summary of existing and future needs is followed by a summary of data from each of the region's 11 subregions. Commercial navigation centers around the major coastal harbors, particularly those of Los Angeles and San Francisco, as does the recreational fleet of individual pleasure craft. Steady increases in the use of navigation and in commercial and pleasure craft are predicted between 1965 and 2020, with a 200% increase in petroleum product shipment projected for this period. Costs of installing proposed commercial and recreational navigation facilities during the study period (1965-2020) would be about $1,543 million and $797 million, respectively, including harbors of refuge for the latter. Recommendations include the incorporation into a master plan of navigation elements set forth in the report, includ-

ing channel widening/dredging; cargo handling area enlargement; construction of a chain of refuge harbors for small craft; more extensive data collection for subregional needs; and an investigation into alternatives to major channel/harbor deepening for petroleum tanker accomodation. (Arnold-NC)
W80-02036

TREATMENT TECHNOLOGY TO MEET THE INTERIM PRIMARY DRINKING WATER REGULATIONS FOR ORGANICS: PART 4,
Environmental Monitoring and Support Lab., Cincinnati, OH. Physical and Chemical Methods Branch.
For primary bibliographic entry see Field 5G.
W80-02043

DEVELOPING A CONSERVATION PROGRAM TAILORED TO AREA NEEDS,
Mathematical Sciences Northwest, Bellevue, WA.
For primary bibliographic entry see Field 3D.
W80-02045

URBAN DROUGHT IN THE SAN FRANCISCO BAY AREA: A STUDY OF INSTITUTIONAL AND SOCIAL RESILIENCY,
Teknekron, Inc., Berkeley, CA.
M. Hoffman, R. Glickstein, and S. Liroff.
American Water Works Association Journal, Vol 71, No 7, p 356-363, July 1979. 7 Fig, 2 Tab.

Descriptors: *Water supply, *Water resources planning, *Water costs, *Water conservation, *Water policy, *Water use, *Droughts, *Water demand, Water consumption, San Francisco(CA), California, Social aspects, Institutions, Governments, Water rationing, Water yield, Water supply development.

The authors analyze the political and policy making climate surrounding decisions about how to deal with the 1976 and 1977 droughts in the San Francisco Bay Area. The study focussed on 8 agencies supplying water to more than 3 million people. Major area water supplies differed greatly in their vulnerability to the drought. Droughts can usually be predicted with some accuracy by mid-February of the December-March rainy season in this area, leaving only a short span of 6-8 weeks in which to make decisions about the whole year's precipitation. In addition, staff philosophy that drought years do not occur back to back contributed to water utility failure to plan adequately for drought conditions. Factors influencing successful drought planning included the early institution of a water rationing plan and development of policies to augment area water supply. Marin County had to cut its consumption by as much as 57% due to its policies, yet a Santa Clara County utility had adequate groundwater supplies and adequate planning so that no cutback to customers during the droughts was required. The major outcome of the droughts is to cause localities to abandon traditional water planning and to incorporate structural and behavioral conservation modes in customer water use. (Arnold-NC)
W80-02046

LABOR WAGE RATES, PRODUCTIVITY, AND THE COST OF WATER SUPPLY,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 6C.
W80-02047

ASSESSING PUBLIC GROUND-WATER SUPPLIES IN ILLINOIS,
Illinois State Water Survey, Urbana. Hydrology Section.
For primary bibliographic entry see Field 2F.
W80-02170

GROUND-WATER RESOURCE MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Inst. of Agriculture and Natural Resources.
For primary bibliographic entry see Field 4B.
W80-02171

FUTURE SOURCES OF COOLING WATER FOR POWER PLANTS IN ARID REGIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 3E.
W80-02354

6E. Water Law and Institutions

THE NEW LAW OF THE SEA OPPORTUNITIES FOR OCEAN INDUSTRIES,
University of Wales Inst. of Science and Technology, Cardiff.
A. V. Lowe.
Ocean Management, Vol 4, p 151-161, 1978.

Descriptors: *UNCLOS III, *Informal composit negotiating text, *Ocean industries, *International law, *International waters, Political aspects, Economics, Investment, Fisheries, Energy, Legal aspects, Water policy, Oil, Governments, Oceans, Mining, Exclusive economic zone, Offshore platforms, Planning, Marine resources, Continental shelf, Industries.

Implications of the Informal Composite Negotiating Text of the Third United Nations Conference on the Law of the Sea (UNCLOS III) for ocean resource development are outlined. Two new factors are overturning the former laissez-faire approach to ocean resources: (1) emergence of the 200 mile Exclusive Economic Zone which gives countries exclusive rights over the sea's resources will probably bring more than one third of the high seas under the control of coastal nations, and (2) UNCLOS III is attempting to establish an international authority to govern development of the deep sea bed which lies beyond the continental boundaries of coastal States. This would establish a clear legal jurisdiction for these areas, which could give commercial operators secure legal rights against third parties and encouraging investment. It also could equally restrict operations in these areas. Fisheries, fish farming, petroleum, wave power and other installations, pollution, conflicts of use, disputes, deep sea bed exploitation, scientific research and transfer of technology are discussed in the context of these implications. Other considerations of importance to the ocean industries are preferential rights given to developing Third World States, the political stability of the host state to protect investments, and time factors involved in putting UNCLOS III into force. (Luedtke-Wisconsin)
W80-02005

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: MAIN REPORT.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6B.
W80-02033

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: APPENDIX XVI-SHORELINE PROTECTION AND DEVELOPMENT.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6B.
W80-02035

THE DARK AND BLOODY GROUND OF INDIAN WATER RIGHTS: CONFUSION ELEVATED TO PRINCIPLE,
California Univ., Los Angeles. Dept. of History.
N. Hundley, Jr.
The Western Historical Quarterly, Vol 9, No 4, p 455-482, October 1978. (California Water Resources Center Project UCAL-WRC-W-516). OWRT-A-059-CAL(2).

Descriptors: *Water rights, *Indian reservations, Legal aspects, Prior appropriation, Prescriptive rights, Water law, Federal-State Water Rights Conflicts, Irrigation, Irrigated land, Equitable apportionment, Water allocation(Policy).

What is an adequate supply of water, and how does the Indian justify his right to it. The purpose of this essay is to provide a measure of historical perspective for this question and the current disputes over Indian water rights, disputes in which the opponents invariably invoke history (or what they claim to be history) in their battles with one another. The focus is on the major developments in what has come to be euphemistically known as Indian water law and on what appear to be the principal reasons for the patterns that have emerged. (Snyder-California)
W80-02077

WHAT COULD WATER REGULATIONS COST,
Southern Illinois Univ. at Carbondale.
For primary bibliographic entry see Field 6C.
W80-02132

MANAGEMENT OF RECREATIONAL FISHERIES IN NORTHERN QUEBEC: POLICIES VERSUS TOOLS,
Brock Univ., St. Catharines (Ontario). Inst. of Urban and Environmental Studies.
F. Berkes.
Canadian Public Policy, Vol 4, No 4, p 460-473, 1978. 3 Tab, 20 Ref.

Descriptors: *Quebec, Canada, *Sport fishing, *Water policy, *Fish management, *Regulation, *Fisheries, Recreation, Management, Exploitation, Indian reservations, Freshwater fish, Salmonids, Cold-water fishing, Public lands, Reasonable use, James Bay, Canada, Fish populations, Social participation, Social aspects, Social impact, Conservation.

Implicit policy assumptions, as revealed by management tools, are explored with respect to recreational fishery management in northern Quebec, Canada. Sport fishing in this area has been almost eliminated since 1972, pending court case and negotiations which led to the James Bay and Northern Quebec Agreement between governments (federal and provincial), native parties (Cree Indians and Inuit) and development corporations. The agreement was signed in 1975 but recreational fishing is delayed until 1984 and construction completion of La Grand Hydro Complex. Alternative fishery management strategies are liberal or large yields and conservative or multiple-use. The large-yield strategy works only as long as fishing pressure is low in comparison to biological potential. Large yield strategies have resulted in mismanaged fisheries and it is unrealistic to expect that stocks are conserved by gradually tightening regulations as fishing activity increases; it is necessary to establish preventive measures. The conservation and multiple-sue strategy implies management for relatively low but sustained-yield, long-term productivity and a quality environment. Native people gain most from the conservation strategy, since recreational fishery social impacts are minimized with relatively slow and controlled growth. Management tools include daily bag limits, closed fishing seasons, fish sanctuaries, closed to the fishing year-round, regulation enforcement, catch monitoring and scientific research on fisheries, and total catch control by quotas. (Danovich-Wisconsin)
W80-02138

COMMITMENTS, PRIORITIES, AND ORGANIZATION OPTIONS FOR WATER RESOURCE PLANNING IN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Political Science.
J. W. Westphal, and J. J. Lawler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122799, Price codes: A16 in paper copy, A01 Microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, August 1979. 346 p 15 Fig, 32 Tab, 5 Append. OWRT A-076-OKLA(1). 14-34-0001-8038.

Descriptors: *Institutional constraints, *Inter-basin transfers, *Interconnected systems, *Water resources development, *Water allocation, *Water resources planning, Legal aspects, Institutions, Ad-

ministration, Water law, Water management, Water policy, Political constraints, Water rights.

Interbasin water transfer from eastern to central and western Oklahoma was analyzed from he standpoint of present commitments and priorities of existing water supplies, available options for water development, and processes of water resource planning. Research method included interviews, a statewide mailbag elite-option survey, legal research, and analysis of legislative bills and other documents. Legal constraints discussed included: Oklahoma's dual water rights system in which prior appropriation governs streamwater and surface ownership determines groundwater rights, statutory protection of the area of origin, federal and state environmental legislation, and Indian claims to waters designated for transfer. Institutional constraints include historic identification of the Oklahoma Water Resources Board with the controversial transfer plan, interagency rivalry for jurisdiction over aspects of water resources, and area of origin controlling more seats in the Oklahoma House of Representatives than the other regions. Survey findings and legislative analysis indicate a tripartite regional division, in which the intermediate position of Central Oklahoma on the issue has been decisive in coalitions. Given these constraints, the following alternatives for water development policy were evaluated: definitions of 'surplus water' based on prior rights or future needs, and of 'area of origin' on a hydrologic or governmental basis, appropriate safeguards for the area of origin and for 'instream' values, various proposals for reorganizing adjudicative, planning and financing functions relating to water, the potential for using non-structural modes of water development, and procedures for quantitative evaluation of economic impacts.
W80-02194

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
United States Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C., FWS/OBS-78/97, November, 1978, 255 p.

Descriptors: *Wetlands, *Preservation, *Water resources development, Values, Hazards, Environmental effects, Federal government, Federal project policies, State governments, Local governments, Legislation, Jurisdiction, Legal aspects, Political aspects, Regulation, Mapping, Rehabilitation, Research and development, Land use, Management, Ecology, Freshwater marshes, Tidal marshes, Salt marshes, Marshes, Estuaries, Swamps.

An overall view is presented of the status of the wetland protection effort in the United States. Sections deal with wetland values and hazards, the impact of development, specific State programs, Federal agency roles, case studies of wetland uses and misuses, legal issues, wetland mapping, wetland rehabilitation, the role of the private sector and the public, and research priorities. A summary outlines future directions for the wetland protection movement. (See W80-02254 thur W80-02294) (Howard-Mass).
W80-02253

THE HAZARDS OF WETLANDS USE,
Colorado Univ., Boulder. Inst. of Behavioral Science.
G. F. White.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 3-5, 1978. 3 Ref.

Descriptors: *Wetlands, *Hazards, *Land use, *Preservation, Federal government, Insurance, Flood damage, Land development, Environmental effects, Damages, Water resources development, Erosion control.

Wetlands are subject to coastal or riverine flooding, beach erosion, and to the effects of excessive or deficient periods of precipitation. Many are vulnerable to earthquakes, landslides, or subsidence and a few are threatened by avalanches, tsunami, or volcanoes. Efforts to reduce the social impacts of extreme events under national policies for flood control, drainage, and beach erosion control may have a profound and unanticipated effect upon the future quality of the wetlands. Those efforts which do not adequately allow for the infrequent occurrence may turn out to be counterproductive. The practical measure most likely to advance wetlands protection in the near future is strengthening of the provisions of the Federal Flood Insurance Program for State support of community planning in hazardous areas. (See also W80-02253) (Howard-Mass).
W80-02254

WETLAND VALUES,
Connecticut Coll., New London.
For primary bibliographic entry see Field 6B.
W80-02255

VALUE OF WETLANDS AS DOMESTIC ECOSYSTEMS,
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 6B.
W80-02256

OVERVIEW OF MAJOR DEVELOPMENT IMPACTS ON WETLANDS,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6B.
W80-02257

ONE WAY A WETLANDS BILL MAY BECOME LAW,
New Hampshire House of Representatives, Concord.
M. Taylor.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 45-46, 1978.

Descriptors: *Wetlands, *Legislation, *Governments, *Water resources development, Administrative agencies, Legal aspects.

Numerous pressure points are discussed where public decisions on wetland proposals may be influenced by the public during the process of changing an idea into a bill and the bill into law. Once a wetlands act becomes law, new agency regulations may have to be promuglated, appropriations secured, and personnel shifts made. The proponents and legislative sponsors should sit down and work with the administrative agency to make sure they have a 'feel' for what is intended. (See also W80-02253) (Howard-Mass)
W80-02260

STATE OF GEORGIA: WETLANDS POLICIES AND PERSPECTIVES,
Georgia Dept. of Natural Resources, Brunswick.
F. C. Marland, and J. R. Bozeman.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 47-52, 1978. 1 Tab, 20 Ref.

Descriptors: *Wetlands, *Legislation, *Georgia, Federal government, Environmental effects, Dredging, Spoil banks, Water resources development, Marshes, Freshwater marshes, Salt marshes, Administrative agencies, Tidal marshes, State governments.

The greater impacts to Georgia's wetlands at present are from Federally assisted programs in the areas of agriculture, transportation, and navigation. A holistic approach to the management and utilization of wetlands,by the agencies involved is urged. Recommendations for the Corps' navigation projects in Georgia include elimination of overboard spoiling on productive bay bottoms and sounds and reductions in dredging operations. It is recommended that Phase III of Section 404 of the Federal Water Pollution Control Act be delayed, and that extensive consultation between all levels of government be carried out along with public hearings. Each region of the country, with its varied agriculture and forestry practices, can best determine a workable 404 program. (See also W80-02253) (Howard-Mass)
W80-02261

IMPLEMENTATION OF THE VIRGINIA WETLANDS ACT OF 1972,
Virginia Inst. of Marine Science, Gloucester Point.
G. M. Dawes.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston , Virginia, p 53-56, 1978. 8 Ref.

Descriptors: *Wetlands, *Legislation, *Virginia, *Preservation, Salt marshes, Water resources development, Local government, Administrative agencies, State government, Regulation.

In the five years of implementation of the Virginia Wetlands Act, 26 out of about 40 counties and cities containing wetlands have established local wetland boards and are managing their own wetlands under the general supervision of the Virginia Marine Resources Commission. About 85 percent of Virginia's tidal wetlands are now under local control. Training of a considerable body of laymen has been accomplished. The annual rate of tidal wetland loss has decreased from 400 to 600 acres to 20 acres or less. The number of wetland applications, both numerically and as a percentage of all shoreline applications, has dropped while preapplication advisory actions of the Virginia Institute of Marine Science and the local boards has increased. An area of concern lies in the cumulative effect of many small projects and the fact that no comprehensive regulatory plan exists for inland non-tidal wetlands. Agencies must better coordinate and administer wetland laws to avoid future efforts to weaken their provisions. (See also W80-02253) (Howard-Mass)
W80-02262

MARYLAND'S WETLAND PROGRAM: A MANAGERIAL VIEW--FROM THE INSIDE,
Maryland Water Resources Administration, Annapolis.
H. M. Cassell.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 57-61, 1978. 2 Tab.

Descriptors: *Wetlands, *Regulations, *Maryland, *Legislation, Environmental effects, Political aspects, Economics, Data collection, Water resources development, State governments.

The record and costs of the Maryland Wetland Program of 1970 are examined along with the existing data utilized by wetland managers in the state. The most pressing administrative need is for an organizational framework that will provide for the orderly acquisition of data. Some of the present data needs are related to: the decline of submerged aquatic plants; impacts of overboard disposal; location to acceptable spoil disposal sites; the ranges of exotic, threatened, or endangered species; and impacts of repeated burning of wetlands on nutrient and detritus releases. Public and private wetland acquisition programs in the State are discussed. (See also W80-02253) (Howard-Mass)
W80-02263

WETLAND PROTECTION EFFORTS, NEEDS, AND PRIORITIES IN WISCONSIN,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
B. Bedford.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 63-68, 1978. 7 ref.

Descriptors: *Wetlands, *Legislation, *Preservation, *Wisconsin, Freshwater marshes, Water resources development, State government, Values, Administrative agencies.

The Wisconsin Conservation Department (Department of National Resources since 1967) has actively pursued a wetlands acquisiton program since

1930 in the name of hunting and fishing. Wetland protection in the State has resulted from the relationship of wetlands to navigable bodies of water, a relationship which brings some wetlands within the domain of the Public Trust and Shoreline Zoning Program. Despite a strong legal base, enforcement is eask and violations are numerous. Attempts have been made in the State legislature to weaken the definition of navigability. Many of Wisconsin's wetlands are not connected, or are connected by groundwater only, with navigable bodies of water. To date, attempts to adopt a specific wetland protection statute have been unsuccessful. Qualified field personnel, money for people to do the work, an accurate inventory, cooperation between agencies, public education, and a way to deal with the schism between agricultural and wetland values are all needed in order to bring about effective wetland protection in Wisconsin. (See also W80-02253) (Howard-Mass)
W80-02264

PROTECTION OF MASSACHUSETTS WETLANDS BY ORDERS OF CONDITIONS ISSUED BY LOCAL CONSERVATION COMMISSIONS,
Tufts Univ., Medford, MA. Dept. of Biology.
N. H. Nickerson.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 69-76, 1978. 7 Ref, 3 Append.

Descriptors: *Wetlands, *Legislation, *Massachusetts, *Preservation, Marshes, Freshwater marshes, Salt marshes, Local governments, Administrative agencies, Jurisdiction, Water resources development, State government, Permits.

The historical aspects of wetlands protection in Massachusetts are reviewed, and a discussion is provided of the mechanics and of the advantages and disadvantages of the State's local restriction approach to wetland protection. This approach could be adopted on a wider national scope. Local citizen commissions would need competent education on whatever wetland law is adopted, on conducting hearings, and on permitting and appeals proceedings. The Commissions should have technical expertise available, a facet which could be accomlished through the Soil conservation Service or Conservation Districts already present. Care should be taken that these broadly based groups do not have primary jurisdiction for wetland protection as they suffer from intensitivity to local situations and an inability to police their restrictions. (See also W80-02253) (Howard-Mass)
W80-02265

MASSACHUSETTS WETLAND RESTRICTION PROGRAM,
Massachusetts Dept. of Environmental Management, Boston.
M. Hardin.
In: Proceedings of the National Wetland protection Symposium, June 6-8, 1977, Reston, Virginia, p 77-84, 1978. 4 Append.

Descriptors: *Wetlands, *Massachusetts, *Preservation, *Legislation, Marshes, Freshwater marshes, Salt marshes, Tidal marshes, Local governments, Water resources development, Jurisdiction, State governments, Permits.

Administration of Massachusetts' Coastal Act is relatively simple. The wetlands are mapped and very little use is allowed that would interfere with the flow of water, the movement of sediments, or that would destroy vegetation. Inland wetlands do not fall neatly into categories, and problems arise in implementing the Inland Wetland Act's proposed policy of restricting use only on critical wetlands. An array of questions is listed which would help determine if a wetland may be termed 'critical.' Under the restriction program, appeals are few and violations fewer. For areas that should remain inviolate, restrictions make more sense than simple permit procedures. The major problems with the program arise from the tedious recording process and the lengthy process of working with individual landowners and town boards. (See also W80-02253) (Howard-Mass)
W80-02266

POLITICAL PROBLEMS ASSOCIATED WITH THE PASSAGE OF MEANINGFUL WETLANDS LEGISLATION: THE NEW HAMPSHIRE EXPERIENCE,
New Hampshire House of Representtives, Concord.
M. Taylor.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 85-86, 1978.

Descriptors: *Wetlands, *Preservation, *New Hampshire, *Legislation, Jurisdiction, State governments, Local governments, Water resources development.

Since 1973, there has been an effort in New Hampshire to bring the evenhandedness of state enforcement together with local concern and scrutiny in the state's wetland policy. New Hampshire has a far-reaching wetland act which extends to all surface waters of the state and the adjacent land, but a problem arises in the area of commitment to adequate enforcement. It has been determined that the State, not the municipalities, has final jurisdiction over wetlands. Some proposed changes in the law are outlined. (See also W80-02253) (Howard-Mss)
W80-02267

CRITICAL WETLANDS ACQUISITION: WISCONSIN SCIENTIFIC AREAS,
Wisconsin Dept. of Natural Resources, Madison.
C. Germain.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 87-94, 1978. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Wetlands, *Preservation, *Wisconsin, *Legislation, Land management, Land use, Bogs, Grasslands, Swamps, Ecology, Ecological distribution, Ecosystems.

An estimated 2.5 million acres remain of the original 9 million acres of wetland soil in Wisconsin. Of the 2.5 million acres, about 1 million are already secure in some form of public conservation ownership. Most of the ownership occurs in the northern forests where losses have been negligible compared to the southeastern portion of the State. Compared to other natural lands in southern Wisconsin, wetlands, especially the more permanent types, have resisted change and now remain as essentially the only stable, natural communities and refuges for endangered plants and animals in the developed counties. Fee acquisition remains the best means of long-term preservation in Wisconsin. Scientific areas, 50% of which are wetland types, represent presettlement vegetation types in locations where they naturally occur and are a small but high impact segment of the state's conservation lands. The scientific area system alone will preserve only a few good representative examples of each of the 70 to 80 natural area types recognized, including the highest quality bogs, wet prairies, sedge meadows, river bottom forests, and conifer swamps. The large regions of parks, wildlife areas, forests, and other protected areas will help preserve natural diversity in the State. (See also W80-02253) (Howard-Mass)
W80-02268

AN OVERVIEW OF WETLAND PROTECTION EFFORTS IN NEW YORK STATE,
New York State Dept. of Environmental Conservation, Albany.
B. Haines.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 95-97, 1978.

Descriptors: *Wetlands, *Legislation, *Preservation, *New York State, Tidal marshes, Marshes, Swamps, Bogs, Local governments, State governments, Jurisdiction, Water resources development, Administrative agencies, Permits.

The several significant differences between the two regulatory permit programs in the State of New York dealing with the protection of wetland resources, the Tidal Wetlands program and the Freshwater Wetlands program, are discussed in terms of their scope and areas subject to regulation. The most critical problem encountered in the implementation of both wetland laws is lack of money. The size of the State and the number of wetlands involved become problems in the implementation of the Freshwater Wetlands Act. County councils and municipal commissions concerned with the inventory, protection and preservation of many elements of the natural environment act as important sources of information for the Department and provide education and assistance to local governments and the public. The two wetland programs added to the older Protection of Waters program provide one of the most comprehensive water resource protection efforts in the Nation. (See also W80-02253) (Howard-Mass)
W80-02269

THE FEDERAL ROLE IN WETLAND PROTECTION: AN OVERVIEW,
Environmental Defense Fund, Washington, DC.
M. J. Bean.
In: Proceedings of the National Wetland Protection symposium, June 6-8, 1977, Reston, Virginia, p 103-107, 1978.

Descriptors: *Federal government, *Legislation, *Wetlands, *Preservation, Regulation, State governments, Local governments, Administrative agencies, Water resources development, Programs, Federal project policies.

Several important Federal programs affecting wetlands are discussed to illustrate the various roles the Federal Government has historically played in wetland matters. This role will doubtlessly remain multi-faceted in the future, but growing recognition of the diverse values served by wetlands indicates that some movement toward a better coordination of the many Federal progams affecting wetlands can be expected. After the Federal programs are successfully integrated with each other, the more challenging task of coordinating them with state and local programs remains. (See also W80-02253) (Howard-Mass)
W80-02270

WETLAND PROTECTION PROGRAMS OF THE U.S. FISH AND WILDLIFE SERVICE,
Fish and Wildlife Service, Washington, DC. Office of Biological Services.
A. Hirsch.
In: Proceedings of the National Wetland protection Symposium, June 6-8, 1977, Reston, Virginia, p 109-115, 1978.

Descriptors: *Federal government, *Wetlands, *Preservation, *Legislation, Programs, Wildlife, Waterfowl, Regulation, water resources development, Research and development, Federal project policies.

The United States Fish and Wildlife Service's role in wetland protection involves three main lines of activity: wetland acquisition; participation in the environmental planning and regulatory process; and conduct of research, studies, and inventories. Original involvement stemed from the agency's responsibility for protection and management of migratory birds, particularly waterfowl. As public environmental awareness and the service's responsibilities have broadened, its programs have reflected concern for the wide range of values involved in wetlands preservation. (See also W80-02253) (Howard-Mass)
W80-02271

SCS AND THE CONSERVATION OF WETLANDS,
Soil Conservation Services, Washington, DC.
R, M. Davis.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 117-118, 1978.

Descriptors: *Wetlands, *Preservation, *Programs, Federal government, Land use, Water resources

development, Soil conservation, State governments, Local governments, Administrative agencies, Conservation, Values.

The Soil Conservation Service offers technical assistance, mainly through 3,000 local conservation districts, in many aspects of resource conservation to individuals, organization, local and state agencies, and other Federal agencies. SCS participation in activities that alter wetlands is limited by technical constraints, mainly soil potential, and by policy constraints. The agency's main goals in wetland protection are to help maintain and manage existing wetlands to help retain or increase their value, and to help balance their value with that of land for food and fiber production. (See also W80-02253) (Howard-Mass)
W80-02272

THE POTENTIAL FOR MANAGING AND PROTECTING COASTAL WETLANDS THROUGH APPROVED COASTAL MANAGEMENT PROGRAMS,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Coastal Zone Management.
R. W. Knecht.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 119-122, 1978.

Descriptors: *Coastal marshes, *Management, *Legislation, *Jurisdiction, Federal government, State governments, Administrative agencies, Wetlands, Preservation, Water resources development, Federal project policies.

In passing the Coastal Zone Management Act (CZMA), Congress declared the need to develop a national program for the responsible management, beneficial use, protection, and development of coastal resources. Congress made a decision to focus coastal planning and management at the state level of government and, therefore, created a program to encourage coastal states to take a lead role by exercising their full authority over coastal resources in cooperation with Federal and local governments and other concerned interests. Present efforts under the CZMA are described as well as the possibilities the Coastal Zone Management Program holds for the future in terms of assisting in the management and protection of coastal wetlands. (See also W80-02253) (Howard-Mass)
W80-02273

CORPS OF ENGINEERS EFFORTS RELATED TO WETLAND PROTECTION,
Office of the chief of Engineers (Army), Washington, DC.
J. R. Hill, Jr.
In: proceedings of the National Wetland protection Symposium, June 6-8, 1977, Reston, Virginia, p 127-132, 1978.

Descriptors: *Wetlands, *Preservation, *Federal government, *Programs, Dredging, Landfills, Values, Water resources development, Administrative agencies, Permits, Regulation, Federal project policies.

The U.S. Army Corps of Engineers' authority to regulate wetland activities is derived from Section 10 of the River and Harbor Act of 1899 and Section 404 of the Water Pollution Control Act Amendments of 1972. The rules followed in evaluating permit applications for dredge and fill operations are explained. If a wetland serves one or more of the functions considered important, no permit affecting that wetland will be granted unless the benefits of the proposed alteration outweigh the damage to the wetland rsource and the proposed alteration is necessary to realize those benefits. the significant difference between Corps projects and regulated private activities is that a less broad public interest review criteria is applied to Corps projects. The Corps' wetlands policy and EPA guidelines, reasonably and sensitively applied, provide a means of limiting the alteration or destruction of wetlands to that which is truly in the public interest. (See also W80-02253) (Howard-Mass)
W80-02275

EPA'S WETLAND RELATED PROGRAMS,
Department of Justice, Washington, DC.
V. Hughes.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 133-137, 1978. 1 Tab, 1 Append.

Descriptors: *Federal government, *Programs, *Wetlands, *Preservation, Administrative agencies, Permits, Legislation, Local government, State government, Water resources development, Regulation, land use, Dredging, Land fill, Federal project policies.

Several programs implemented by the Environmental Protection Agency that directly or indirectly affect the Nation's wetlands are reviewed. A partnership between the Federal Water Pollution Control Act Section 404 Program and State and local government appears to act effectively in wetland protection in many States. All of the various approaches to wetland protection, from technical assistance through regulatory programs, are needed to achieve some measure of improved decision-making concerning this important part of our aquatic resources. The local, state, and national perspectives should be brought together when maing management decisions. (See also W80-02253) (Howard-Mass)
W80-02276

WETLAND DEVELOPMENT, AN ALTERNATIVE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6A.
W80-02277

GRASSROOTS CONSERVATION OF WETLANDS: THE SANIBEL LAND USE PROGRAM,
Conservation Foundation, Washington, DC.
J. Clark.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 153-162, 1978. 6 Fig, 1 Tab, 2 Ref.

Descriptors: *Wetlands, *Preservation, *Florida, *Legislation, *Local governments, Regulation, Land use, Water resources development, Salt marshes, Freshwater marshes.

Wetlands protection in the City of Sanibel, Florida, is provided by city ordinances. It is accomplished by designating the interior (Spartina) and mangrove wetlands as zones of special ecological significance, allowing only certain uses in wetlands, restricting the density of those uses, and requiring strict performance standards on implementing the uses. This conservation program is based on an innovative method of guaranteeing that uses are restricted to a level and type that would have minimal adverse ecological impact. (See also W80-02253) (Howard-Mass)
W80-02279

THE APALACHICOLA DILEMMA: WETLANDS PRIORITIES DEVELOPMENTAL STRESS, AND MANAGEMENT INITIATIVES,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 163-177, 1978. 10 Fig, 21 Ref.

Descriptors: *Wetlands, *Preservation, *Florida, *Alabama, *Georgia, Legislation, Programs, Freshwater marshes, Salt marshes, State governments, Federal government, Land use, Environmental effects, Drainage, Channeling, Water resources development, Impoundments.

The Apalachicola drainage system in the States of Alabama, Georgia, and Florida includes an extensive array of unspoiled freshwater and estuarine wetlands. It sustains important terrestrial and aquatic biotic associations characterized by high species richness and endemism and a number of rare and endangered species. The estuarine productivity is closely associated with the natural functions of the river and the habitats formed by the barrier island system. Recently introduced or proposed wetland projects including cattle ranching, forestry operation, barrier island development, impoundment and/or channelization of the river, and industrialization of the flood plain could have serious implications for the high productivity of the region. A management strategy for the Apalachicola system is based in part on the application of State laws and Federal regulations and involves preservation of environmentally sensitive lands, determination of key economic and environmental alternatives, and implementation of various environmental programs. The Apalachicola situation represents a unique opportunity for the application of research, education, state and federal regulation, and local planning initiatives to the development of a comprehensive management program for an entire wetlands system. (See also W80-02253) (Howard-Mass)
W80-02280

WETLANDS AND THE TAKING ISSUE,
Conservation Foundation, Washington, DC.
J. S. Banta.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 179-183, 1978.

Descriptors: *Wetlands, *Legal aspects, *Jurisdiction, *Public rights, Governments, Administrative agencies, Economics, Water resources development, Easements, Competing uses, Preservation.

Wetlands are a type of property frequently subject to the navigation servitude, public trust, or another competing public interest. The taking issue, derived from state and Federal Constitutional law, is discussed along with several other related issues.The cast and direction of both legislative policy and current litigation will heavily influence the options open to the scientists and managers of our wetlands in the future. (See also W80-02253) (Howard-Mass)
W80-02281

LESSONS FROM A WET STATE,
Conservation Law Foundation of New England, Inc, Boston, MA.
A. D. Dawson.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 185-195, 1978.

Descriptors: *Wetlands, *Preservation, *Legislation, Public rights, Legal aspects, Hazards, Jurisdiction, Governments, Water resources development, Land use, Zoning, Regulation.

The outcome of 'taking issue' cases in Massachusetts seems to depend upon which end of the problem--protecting the public interest or protecting the private landowner--is first approached by the particular judge. The argument most likely to prevail against private rights is the prevention of public hazard. Local zoning is an acceptable way to protect the flood plains and wetlands, whether or not statewide statutes exist. In individual cases, local officials or State officials may prove more able to resist pressures to develop wetlands, but in some cases only the Federal government will be able to rise above the pressure. From the environmental viewpoint, the best system is the one which offers a system of vetoes, not overriding votes, on the local, state, and federal level. Government, on any level, has no 'constitutional' right to use its land in any particular way, especially in contravention of public policies laid out in constitutions, statutes, or executive orders. The scope of state and federal servitudes over navigable waters, tidal and inland, is growing. One implication of the doctrine appears to be that land may belong to private persons, but the water belongs to the public. (See also W80-02253) (Howard-Mass)
W80-02282

LEGAL AND POLITICAL ISSUES,

Munger, Tolles, Hills, and Rickershauser, Los Angeles, CA.
P. R. Taft.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 197-200, 1978.

Descriptors: *Wetlands, *Federal government, *Legal aspects, *Preservation, *Political aspects, Jurisdiction, Water resources development.

The historical development and bases of the Federal government's power over the waters of the United States are traced. A serious problem in enforcement of Federal programs exists. The development of a substantial local effort, both public and private, is necessary to support the Army Corps of Engineers projects. The lack of public awareness of what is at stake and the still rudimentary knowledge of the interdependency of our ecosystems are larger issues which affect legal, enforcement, and political problems in the area of wetland protection. (See also W80-02253) (Howard-Mass)
W80-02283

WETLANDS, TAXATION, AND THE TAKING ISSUE,
Environmental Law Inst., Washington, DC.
C. C. Harwood.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 201-203, 1978.

Descriptors: *Wetlands, *Taxes, *Preservation, Local government, State government, Water resources development, Land use, Regulation.

Land taxing policies can be used to help avoid the issue of taking, to provide incentives to landowners for wetland protection, and to supplement and enhance legislative policy decisions to protect wetlands. Local government must take the initiative to reassess properties subject to regulations restricting development. To encourage this, States should provide them with maps that indicate wetlands subject to development restrictions. States should also encourage the use of voluntary conservation restrictions and require that their impact on land values be reflected in property assessments. At the same time, private property owners should be educated and encouraged to take advantage of laws that promote wetland protection in exchange for real property income, estate, and gift tax advantage. (See also W80-02253) (Howard-Mass)
W80-02284

MITIGATION: A CONCEPT FOR WETLAND RESTORATION,
Oregon State Dept. of Land Conservation and Development, Salem.
E. T. LaRoe.
In: Proceedings of the National Wetland Proection Symposium, June 6-8, 1977, Reston, virginia, p 221-224, 1978.

Descriptors: *Estuarine environment, *Preservation, *Legislation, *Oregon, Salt marshes, Wetlands, Dredging, Landfill, Ecological effects, Ecology, State governments.

Dredge, fill, or other reduction or degradation of the natural value of estuarine ecosystem is allowed by Oregon's Land-Use Program only if such activities are required for navigation or other water dependent uses that require an estuarine location, if a public need is demonstrated, if no alternative upland locations exist, and if adverse impacts are minimized as much as possible. When dredge or fill activities are permitted, their effects must be mitigated by creation or restoration of another area of similar biological potential to ensure that the integrity of the estuarine ecosystem is maintained. This requirement is intended to provide an area that will, with time, develop a qualitatively and quantitatively similar flora and fauna. The highest priority areas for creation or restoration are those in the general proximity to the fill or dredge site. If such areas are not available, areas in other parts of the estuary may be selected according to the similarity of salinity regime, tidal exposure and elevation, substrate type, current velocity and patterns, orientation to solar radiation, and slope. The third priority for mitigation is to restore areas or resources which are presently in the greatest scarcity compared to their past abundance and distribution. (See also W80-02253) (Howard-Mass)
W80-02288

PUBLIC INVOLVEMENT IN WETLAND PROTECTION DOES MAKE A DIFFERENCE.
Massachusetts Audubon Society, Lincoln.
J. Colman.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 229-232, 1978. 1 Append.

Descriptors: *Wetlands, *Preservation, *Massachusetts, *Local governments, Political aspects, Regulation, Permits, Publications, Legislation.

Wetland protection is basically a political process which requires educated public involvement in order to succeed. At the local level, many citizens feel they will be taken seriously and so have incentive to participate in protection efforts. Massachusetts has a good model for building public involvement into the wetland regulatory process. (See also W80-02253) (Howard-Mass)
W80-02290

PUBLIC PROCESSES AND PUBLIC INVOLVEMENT IN WETLAND REGULATORY PROGRAMS,
Connecticut Dept. of Environmental Protection, Hartford.
A. N. Williams.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 233-241, 1978 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Wetlands, *Regulation, *Programs, Permits, Connecticut, Masschusetts, Preservation, Administrative agencies, Water resources development.

To date, public involvement in wetland regulation has concerned itself primarily with the passage of wetland acts. The public does not involve itself with overseeing regulatory agencies and is therefore writing off many valuable wetlands. Public regulatory agencies find it difficult to educate the public in wetland values, or to actively solicit public involvement in regulatory affairs because of financial or political restraints. A mechanism must be initiated which will mandate incorporation of citizen input into the regulatory and management processes and develop technical capability throughout a region. (See also W80-02253) (Howard-Mass)
W80-02291

STREAM CHANNELIZATION (P.L. 83-566) INCREASED WETLAND LOSSES IN THE DAKOTAS,
Fish and Wildlife Service, Bismark, ND.
R. E. Erickson, R. L. Linder, and K. W. Harmon.
Wildlife Society Bulletin, Vol 7, No 2, p 71-78, Summer, 1979. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Channeling, *Wetlands, *Environmental effects, *North Dakota, *South Dakota, Streams, Channel improvement, Drainage, Ecology, Watershed management, Water resources development, Legislation, Legal aspects, Political aspects, Cost sharing, Flood protection, Federal project policies.

Stream channelization under the Small Watershed Program (P.L. 83-566) was the major influence on wetland drainage in the Wild Rice Creek Watershed in North and South Dakota. Drainage rates were 2.6 times higher in the channeled area than in the unchanneled area during project planning and 5.3 times higher during and following construction. Although the channel's claimed benefits were watershed protection and flood control, the channel permitted and stimulated wetland drainage deleterious to wildlife. Substantial legal, policy, and administrative changes are necessary to prevent such habitat loss. Basic in any change is an overriding consideration of public values, such as wildlife, when public funds are involved, with cost-sharing rates that reflect and promote this concern. Especially when wetlands are present, base acreages need to be established early in project planning, and the sponsor should be required to show how wetlands will be protected as a condition for receiving public funds. Recent executive orders and policy guidelines on wetlands and channelization express a national concern for wetlands and may be helpful, but do not address fundamental cost-share issues and therefore are not believed to be adequate to protect wetlands in these projects. (Howard-Mass)
W80-02300

6F. Nonstructural Alternatives

MANAGEMENT OF RECREATIONAL FISHERIES IN NORTHERN QUEBEC: POLICIES VERSUS TOOLS,
Brock Univ., St. Catharines (Ontario). Inst. of Urban and Environmental Studies.
For primary bibliographic entry see Field 6E.
W80-02138

WETLAND VALUES,
Connecticut Coll., New London.
For primary bibliographic entry see Field 6B.
W80-02255

THE NATIONAL FLOOD INSURANCE PROGRAM AND WETLAND PROTECTION,
Federal Flood Insurance Administration, Washington, DC.
R. W. Krimm.
In: Proceedings of the National Wetland Protecton Symposium, June 6-8, 1977, Reston, Virginia, p 123-125, 1978.

Descriptors: *Wetlands, *Preservation, *Flood protection, *Insurance, Values, Flood damage, Programs, Administrative agencies, Coastal marshes, Marshes, Landfills, Federal project policies.

The National Flood Insurance program (NFIP) was designed to reduce loss of life and property from floods. Part of the program's responsibility involves the development and enforcement of floodplain management standards to reduce flood damages. Regulation recently adopted requires that communities wishing to qualify for the program protect mangrove stands and dunes which act as barriers to storm surges. The program also indirectly protects wetlands in several ways. It establishes disincentives for location of structures in areas of known flood risk, prohibits the use of fill for elevation purposes in identified coastal high hazard areas, and encourages use of columns for elevation to minimize the use of fill. A discussion is provided of the recent wetland and floodplain executive orders and their relations to the NFIP. (See also W80-02253) (Howard-Mass)
W80-02274

WETLANDS, TAXATION, AND THE TAKING ISSUE,
Environmental Law Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W80-02284

THE ROLE OF THE PRIVATE SECTOR IN WETLAND PROTECTION,
Nature Conservancy. Arlington, VA.
L. G. Low.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 225-228, 1978.

Descriptors: *Wetlands, *Preservation, *Public lands, Land use, Legislation, Legal aspects.

The private sector must provide a stimulus for public action in the preservation of wetlands and other natural areas through legislation, lobbying, and litigation activities. The private sector can also

take direct action to fill the gaps that exist in the public sector and to set a model for the public sector to follow. The Nature Conservancy, a national non-profit membership organization, takes such direct action through the acquisition of land by direct purchase, gifts, and by working in cooperation with public agencies. (See also W80-02253) (Howard-Mass)
W80-02289

6G. Ecologic Impact Of Water Development

COMPREHENSIVE FRAMEWORK STUDY-CALIFORNIA REGION: MAIN REPORT.
California Region Framework Study Committee.
For primary bibliographic entry see Field 6B.
W80-02033

SHORT AND LONG-TERM IMPACTS OF THE RIVER NILE PROJECTS,
Water Management and Irrigation Technologies Research Inst. Cairo (Egypt).
M. Abu-Zeid.
Water Supply and Management, Vol 3, No 4, p 275-283, 1979. 4 Tab.

Descriptors: *Environmental effects, *Water distribution(Applied), *Water supply development, *Water storage, *Water demand, *Dams, *Reservoirs, Floods, Droughts, Fisheries, Water quality, Public health, Potential water supply, Silting, River basin development, Water management(Applied), Dependable supply, Water utilization, Storage requirements, Feasibility studies, Egypt, Nile River, Aswan High Dam.

A detailed examination of Egypt's supplies and demands for water indicates that the Nile River has been and still is the principal factor in the development of this arid country. Full control of Nile Water depends, however, on the Aswan High Dam, completed in 1968 which has created the huge long-term, man-made reservoir, Lake Nasser. The execution of this dam, a scheme of colossal dimensions calling for heavy expenses and enivisaging far off objectives was preceded by extensive feasibility studies and has had both positive and negative effects. These effects which include protection against high floods and droughts, and such agricultural and environmental impacts as siltation of lakes, degradation downstream, loss of silt on agriculture, impacts on fisheries, water quality changes and public health impacts, form the basis of this paper. It is felt that the negative effects are far outweighed by benefits so far accrued. (Tickes-Arizona)
W80-02206

THE BIOLOGY OF SALT WELLS CREEK AND ITS TRIBUTARIES, SOUTHWESTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. J. Engelke, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-300828, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-121, 1978. 82 p, 43 Fig, 15 Tab, 22 Ref.

Descriptors: *Aquatic life, *Biological communities, *Ecosystems, *Water quality, *Water baseline studies, Streams, Wyoming, Food chains, Benthic fauna, Invertebrates, Benthic flora, Nutrients, Water analysis, *Green River basin(Wyo), *Salt Wells Creek basin(Wyo).

A description of aquatic organisms and biological communities is presented for Salt Wells Creek, a plains stream in the Green River basin. The description includes seasonal population fluctuations of benthic organisms and algae, the food pyramid, and nutrient relations between various types of plants and animals. The algae and stream invertebrates were studied to determine baseline data and biological indicators of water quality. (Woodard-USGS).
W80-02232

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

THE HAZARDS OF WETLANDS USE,
Colorado Univ., Boulder. Inst. of Behavioral Science.
For primary bibliographic entry see Field 6E.
W80-02254

OVERVIEW OF MAJOR DEVELOPMENT IMPACTS ON WETLANDS,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 6B.
W80-02257

CRITICAL WETLANDS ACQUISITION: WISCONSIN SCIENTIFIC AREAS,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6E.
W80-02268

SAN FRANCISCO BAY: THE WETLANDS BESEIGED,
J. W. Hedgpeth.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 143-152, 1978. 6 Fig, 15 Ref.

Descriptors: *Salt marshes, *Preservation, *California, Programs, Bays, Wetlands, Land use, Landfill, Dikes, Environmental effects, Mine wastes.

A historical outline is provided of land use surrounding the marshes of San Francisco Bay and its delta. Much of the bay's marshland had been filled or diked off and a considerable alteration in the natural fauna had occurred by 1960. The development and wetland protection efforts of the Bay Conservation and Development Commission are discussed. (See also W80-02253) (Howard-Mass)
W80-02278

PROMISED LANDS, VOLUME 2: SUBDIVISIONS IN FLORIDA'S WETLANDS,
L. Allan, B. Kuder, and S. L. Oakes.
Inform, Inc., New York, NY. 1977. 542 p.

Descriptors: *Florida, *Wetlands, *Environmental effects, *Drainage, Effects, Economic, Pollutants, Marshes, Swamps, Sewage, Subdivisions.

Environmental and consumer impact of nine Florida subdivisions owned by five companies were examined. Two, both initiated in the 1970s, are well-planned using environmentally sound principles. Several developments, however, have had a devastating impact on the environment. These subdivisions have destroyed thousands of acres of valuable fish breeding grounds and wildlife habitat, polluted surrounding waters and created a desolate and sterile environment for future site residents. Separate chapters discuss subdivisions in the 1950s (Port Charlotte and Cape Coral), 1960s (Marco Beach and Silver Springs Shores) and the 1970s (Palm Coast, Citrus Springs and Pine Ridge, Poinciana and Port LaBelle). An appendix discusses guidelines for consumer and environmental protection practices at large-scale subdivisions. A glossary is provided. (Stihler-Mass)
W80-02314

MICHIGAN COASTAL WETLANDS: WHAT GOOD ARE THEY.
For primary bibliographic entry see Field 2I.
W80-02315

AN OVERVIEW OF ST. JOHN'S MARSH, ST. CLAIR COUNTY, MICHIGAN.
Booklet II, MICH U--SG--79--503, March, 1979. 8 p, 2 Fig. Michigan Sea Grant Communications, Ann Arbor, MI.

Descriptors: *Freshwater marshes, *Coastal marshes, *Michigan, Wetlands, Wildlife, Fish, Drainage, Utilities, Protection, St. John's Marsh(MI).

St. John's Marsh, one of the few remaining marshes on Lake St. Clair, provides habitat for wildlife and lake fish. Developers have turned some sections of the marsh into residences and have plans to develop other parts of the marsh. Clay-Township has zoned the marsh for planned residential development; however, many nature and conservation organizations are opposed to this zoning. Planners must consider all public interests when they make final management plans for the marsh. (Stihler-Mass)
W80-02316

LAND MANAGEMENT ALTERNATIVES FOR ST. JOHN'S MARSH, ST. CLAIR COUNTY, MICHIGAN.
Booklet III, MICH U--SG--79--504, March, 1979. 16 p, 6 Fig. Michigan Sea Grant Communications, Ann Arbor, MI.

Descriptors: *Freshwater marshes, *Coastal marshes, *Michigan, *Environmental effects, *Planning, Wetlands, Marshes, Recreation, Wildlife, Urbanization, Fish, Economics, Protection, Lake St. Clair, St. John's Marsh(MI).

Four management alternatives for St. John's Marsh are outlined. These are: Full protection as a wildlife and fish sanctuary, Development into a state recreation area, and partial, and full residential development. All positive and negative aspects of each alternative need consideration when management plans are made. (Stihler-Mass)
W80-02317

THE EFFECTS OF MOWING ON THE DYNAMICS OF QUANTITY, BIOMASS AND MINERAL CONTENTS OF REED (PHRAGMITES COMMUNIS TRIN.),
Polish Academy of Sciences, Warsaw. Dept. of Biocenology.
H. Mochnacka-Lawacz.
Polskie Archiwum Hydrobiologii, Vol 21, No 3/4, p 381-386, 1974. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Marsh plants, *Nutrient requirements, *Plant physiology, *Cutting management, Wetlands, Lakes, Biomass, Plant growth, Nutrients, Calcium, Phosphorus, Marsh management.

The mowing of reed three times during a growing season significantly lowered its biomass, quantity, and percentage of leaves in biomass of sprouting plants. The pattern of seasonal changes of particular mineral ingredients in mown and unmown reed were similar, but the amounts of accumulated substances were different. Elements typical of old plants (ash, silica, calcium) were more abundant in unmown than in mown reed. In the latter, a large proportion of elements typical of young plants was observed (potassium, phosphorus, nitrogen). (Steiner-Mass)
W80-02318

DEVELOPMENT OF SOME LAKE ECOSYSTEMS IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE INVERTEBRATES,
Newcastle-upon-Tyne Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 2I.
W80-02325

EFFECTS OF PEAT UTILIZATION ON WATER QUALITY IN MINNESOTA,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
R. L. Crawford.
Submitted to Minnesota Department of Natural Resources, March, 1978. 18 p, 10 Tab.

Descriptors: *Peat, *Minnesota, *Environmental effects, *Literature, Wetlands, Bogs, Lakes, Water quality, Algae, Nutrients, Metals, Aquatic life.

A literature survey was conducted on experimental work examining: (1) the micronutrients found in typical peatland waters, (2) the effects of bog humic substances on plants and animals receiving waters, and (3) the ability of peat to adsorb metals and other ionic species. In addition, some experiments were done to examine the effect of bog water on algal growth and photosynthesis in lake water. Results indicated that the addition of bog water to nutrient poor northern Minnesota lakes may result in increased algal growth. (Steiner-Mass)
W80-02327

7. RESOURCES DATA

7A. Network Design

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

TECHNIQUES DEVELOPED AND PRESENTLY BEING USED TO CONDUCT THE NATIONAL WETLAND INVENTORY PROJECT,
Fish and Wildlife Service, St. Petersburg, FL. Office of Biological Services.
For primary bibliographic entry see Field 7C.
W80-02285

WETLANDS MAPPING FROM THE LOCAL PERSPECTIVE,
Massachusetts Audubon Society, Lincoln.
For primary bibliographic entry see Field 7C.
W80-02286

PROGRAM AND PRIORITIES FOR WETLAND RESEARCH DEVELOPED BY THE NATIONAL WETLANDS TECHNICAL COUNCIL,
Massachusetts Univ., Amherst.
J. S. Larson, O. Loucks, and J. Clark.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 243-244, 1978.

Descriptors: *Wetlands, *Research and development, *Programs, *Priorities, Preservation, Management, Ecosystems, Data collections, Data processing, Value, Rehabilitation, Water resources development, Assessments.

Major national and regional research questions should be identified and delineated in the context of the functionally based wetland types recognized by the U. S. Fish and Wildlife Service. This will lead to an ongoing mechanism for identifying gaps in the knowledge of specific functional values of wetlands by type and by region. Other areas for near-term research dealing with wetlands include strengthening or establishing national and regional centers for accumulation of information and data exchange, and review and evaluation of the primary technical elements underlying national and international policy concerning wetland conservation. Long-term project needs include: basic research on the dynamics of natural wetland processes and functions, to be considered as a part of a national program of comparative studies of wetland systems; functional assessment of wetlands as units of the landscape; priorities for applied research on the impacts of wetland alteration; and advancement of the understanding of the social significance of wetlands. Special studies should be advanced on the principles of wetlands rehabilitation and restoration, recognition of restoration opportunities, and rehabilitation of the sites of surface mining in wetlands. (See also W80-02253) (Howard-Mass)
W80-02292

SOME RESEARCH PRIORITIES,
Connecticut Coll., New London.
W. A. Niering.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 245-246, 1978 2 Ref.

Descriptors: *Wetlands, *Research and development, *Priorities, Marshes, Salt marshes, Freshwater marshes, Tidal marshes, Succession, Ecology, Vegetation, Rehabilitation, Water resources development.

An investigation is needed on the interplay of hydroperiod, tidal subsidy, salinity, nutrients, oxygen, temperature, microrelief, and substrate conditions and its effect on vegetation types encountered in tidal marshes. A careful scrutiny should be made on the role of successional concepts in interpreting wetland dynamics. High marsh reconstruction and marsh rehabilitation are also priority areas for wetlands research. (See also W80-02253) (Howard-Mass)
W80-02293

RESEARCH PRIORITIES: COASTAL MUD FLATS AND TIDAL FRESHWATER WETLANDS,
Virginia Inst. of Marine Science, Gloucester Point.
E. M. Silberhorn.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 247-249, 1978 6 Ref.

Descriptors: *Tidal wetlands, *Mud flats, *Research and development, *Preservation, Wetlands, Tidal effects, Intertidal areas, Ecosystems, Algae, Productivity, Management.

The salt marsh, mud flat, and the estuary must be considered as portions of a horizontal stratified system. Area differences among these portions alter the potential contribution of each strata to the total ecosystem under regimes of differing tidal amplitude. Research should be directed toward qualitatively identifying and quantitatively determining ecological processes of the mud flat component. There is also limited basic information concerning tidal freshwater wetlands, which have great importance to the marine environment as spawning and nursery areas for alosa fish, to aid in management decisions. These areas are threatened by high wave energy due to boat traffic and the disturbance of normal sedimentation patterns by dams. (See also W80-02253) (Howard-Mass)
W80-02294

7B. Data Acquisition

TECHNIQUES DEVELOPED AND PRESENTLY BEING USED TO CONDUCT THE NATIONAL WETLAND INVENTORY PROJECT,
Fish and Wildlife Service, St. Petersburg, FL. Office of Biological Services.
For primary bibliographic entry see Field 7C.
W80-02285

THE QUANTITATIVE MEASUREMENT OF FOG AND RIME DEPOSITION USING FOG-GAUGES,
Tornado and Storm Research Organization, Trowbridge (England).
For primary bibliographic entry see Field 2B.
W80-02333

DETECTION METHODS FOR LOCATION OF SUBSURFACE WATER AND SEEPAGE,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W80-02334

7C. Evaluation, Processing and Publication

SYNTHETIC HYDROLOGIC INFORMATION--A CASE STUDY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2E.
W80-02185

EVIDENCE OF ACIDIFICATION OF HEADWATER STREAMS IN THE NEW JERSEY PINELANDS,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 5B.
W80-02190

QUALITY OF UNTREATED WATER FOR PUBLIC SUPPLIES IN FLORIDA WITH REFERENCE TO THE NATIONAL PRIMARY DRINKING WATER REGULATIONS,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. W. Hull, and G. A. Irwin.
Florida Bureau of Geology Map Series No 91, 1979. 1 Sheet, 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Florida, *Water quality, *Water supply, *Potable water, Surface waters, Groundwater, Aquifers, Maps, Water analysis, Chemical analysis, Water quality standards, *Untreated water.

This map report shows that virtually all the public supply waters sampled during the August-September 1976 reconnaissance in Florida meet the standards as set forth in the 'National Primary Drinking Water Regulations.' About 130 major public water supplies were sampled for both treated and untreated waters to determine baseline concentrations for those chemical and physical parameters for which maximum contaminant levels were established in the regulations. Several thousand more public supplies exist in the five main aquifers and surface sources than were sampled during this reconnaissance making this only a general overview of the water quality. Results of the water-quality analyses for the untreated samples are summarized by individual parameter on small statewide maps with a discussion of the concentration ranges and potential exceedances in the accompanying text. (Woodard-USGS).
W80-02241

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1978--VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117518, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-78-1, June 1979. 300 p, 7 Fig.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Lake Superior tributaries(Minn), *Red River of the North basin(Minn), *Lake of the Woods basin(Minn).

Water resources data for the 1978 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Great Lakes and Souris-Red-Rainy River basins, and contains discharge records for 77 gaging stations; stage only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 19 gaging stations, 1 partial-record station, 4 lakes, and 20 wells; and water levels for 30 observation wells. Also included are 42 crest-stage partial-record stations and 17 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS).
W80-02246

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1978--VOLUME 2. EASTERN WASHINGTON.

Geological Survey, Tacoma, WA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117526, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WA-78-2, June 1979. 360 p, 19 Fig.

Descriptors: *Washington, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Eastern Washington.

Water resources data for the 1978 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 248 gaging stations, stage only at 4 gaging stations, stage and contents at 44 lakes and reservoirs, water quality at 117 gaging stations (including 6 lakes and reservoirs) and 215 wells, and water levels at 166 observation wells. Also included are data for 96 crest-stage, and 89 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (Woodard-USGS).
W80-02247

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1978--VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-117625, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-78-2, June 1979. 425 p, 9 Fig, 1 Tab.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Upper Mississippi River basin(MN), *Missouri River basin(MN).

Water resources data for the 1978 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the upper Mississippi and Missouri River basins and contains discharge records for 75 gaging stations; stage and contents for 9 lakes and reservoirs; water quality for 35 gaging stations, 1 partial-record station, 24 lakes, and 59 wells; and water levels for 119 observation wells. Also included are 102 crest-stage partial-record stations and 49 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS).
W80-02248

PROCEEDINGS OF THE NATIONAL WETLAND PROTECTION SYMPOSIUM, RESTON, VIRGINIA, JUNE 6-8, 1977.
For primary bibliographic entry see Field 6E.
W80-02253

TECHNIQUES DEVELOPED AND PRESENTLY BEING USED TO CONDUCT THE NATIONAL WETLAND INVENTORY PROJECT,
Fish and Wildlife Service, St. Petersburg, FL. Office of Biological Services.
J. H. Montanari, and B. O. Wilen.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 205-212, 1978.

Descriptors: *Wetlands, *Mapping, *Photogrammetry, *Research and development, Values, Federal government, Economics, Management, Surveys, Application methods, Design, Water resources development.

The National Wetlands Inventory is designed to provide a single, universally applicable system of wetland information which will describe all wetlands on an individual and/or cumulative basis in terms of their ecological and physical characteristics, geographical location, and natural resource values. The existing data, information, and techniques used to meet the goals of the project are discussed. The Wetlands Analytical Mapping System was developed to record the latitude and longitude of the data points and to allow the wetland information to be changed to any required map scale and map projection. The inventory product will aid in the determination of flood control, groundwater, coastal storm damage proection, wildlife, shellfish, finfish, and tertiary waste treatment values of wetland. (See also W80-02253) (Howard-Mass)
W80-02285

WETLANDS MAPPING FROM THE LOCAL PERSPECTIVE,
Massachusetts Audubon Society, Lincoln.
E. Kline.
In: Proceedings of the National Wetland Protection Symposium, June 6-8, 1977, Reston, Virginia, p 213-215, 1978.

Descriptors: *Wetlands, *Mapping, *Massachusetts, Land use, Legislation, Preservation, Maps, Political aspects, Local governments.

It pays in time, money, and wetlands protection for a wetlands map to be drawn to meet specific needs. In Massachusetts, wetlands maps must be based on vegetation because their major use is to aid in administering a law which defines wetlands according to plants. Some field checking is necessary for the maps to be useful at the site-specific level. Politics play a role in determining the map's purpose, content, degree of accuracy, and use. (See also W80-02253) (Howard-Mass)
W80-02286

HURST PHENOMENON AS A PRE-ASYMPTOTIC BEHAVIOR,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W80-02332

A STUDY OF THE PERSISTENCE OF SOME WATER-QUALITY PARAMETERS (ETUDE DE LA PERSISTANCE DE QUELQUES PARAMETRES DE QUALITE DE L'EAU),
Institut National de la Recherche Scientifique, Rimouski (Quebec).
B. Bobee, and D. Cluis.
Journal of Hydrology, Vol 44, No 1/2, p 17-36, November 1979. 3 Fig, 8 Tab, 5 Ref.

Descriptors: *Water quality, *Watersheds(Basins), *Sampling, *Runoff, Analytical techniques, Statistical methods, Ions, Silica, Nitrates, Phosphates, Water sampling, Frequency, Frequency analysis, Analysis, Correlation analysis, Time series analysis, Gaging stations, On-site data collections.

From 1967 to 1975 the water quality service of the Quebec Department of Natural Resources collected 16,000 water samples at 250 stations; in 1975 the number of stations in operation had been reduced to 66 obtained cannot be analyzed by such classical and sophisticated methods as spectral analysis. In order to make use of these date, some less sophisticated, although adequate, methods were considered. In this way, the persistence of several parameters (major ions, silica, nitrate, phosphate) was studied by analyzing the autocorrelation of weekly and monthly series of data and by considering their information content. This technique, based on the analysis of historical data, will indicate the optimal sampling frequencies relative to the types of parameters as well as the hydrographical regions under investigation. (Humphreys-ISWS)
W80-02359

8. ENGINEERING WORKS

8A. Structures

ROMAN DAMS,
Motor-Columbus Consulting Engineers, Inc., Baden(Switzerland).
N. J. Schnitter.
Water Supply & Management, Vol 3, No 1, p 29-39, 1979. 12 Fig, 29 Ref.

Descriptors: *Dams, *Roman dams, *Dam design, *Masonry dams, *Arch dams, *Buttress dams, *Gravity dams, *Rock fill dams, *North Africa, *Roman Empire, *Italy, Dam construction, Excavation, Dam foundations, Dam sites, Earth dams, Earthworks, Reservoirs, Retaining walls.

The author describes the most typical and important PreRoman and Roman dam works in the Mediterranean and Near East areas. The different dams described are divided into one of three types: earth or rock fill, gravity or buttress, and arch. The Subiaco dam was the highest structure built by the Romans and also seems to be their only use of dam engineering in Italy. Roman dams in North Africa are supported by either earth fills or buttresses. Dams up to 7 m high and 900 m long were used in wide and flat valleys and were provided at their two ends with spillways of solid masonry. Especially noteworthy gravity dams were built in the Wadi Megenin 40 km south of Tripoli and they consisted of boulders from the river bed or blocks from quarries laid in mortar. Their vertical upstream faces are carefully plastered while the downstream faces are steeply stepped. These dams are up to 5 m high and have almost rectangular cross-sections of generally ample base width. Oued Derb dam near Kasserine in Tunisia is probably the largest Roman gravity dam in North Africa. North African dams, besides serving to store and/or divert water for irrigation or water supply, were used to retain sediments in order to gain arable land in the wadis. The dam in the Vallon de Baume south of Saint-Remy deProvence in southeastern France was the first application in dam engineering in the area. Roman dam technology, through the capturing of ideas during wars, penetrated far to the East (in the 2nd Century) which took the leadership in this field for many centuries. (Iervolino-NC)
W80-02025

LEAK DETECTION: MODERN METHODS, COST, AND BENEFITS,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6B.
W80-02136

LOW COST, LABOR INTENSIVE COASTAL DEVELOPMENT APPROPRIATE TECHNOLOGY,
For primary bibliographic entry see Field 6C.
W80-02142

SALTWATER-BARRIER LINE IN FLORIDA: CONCEPTS, CONSIDERATIONS, AND SITE EXAMPLES,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5G.
W80-02237

AUTOMATIC WATER-LEVEL CONTROL IN SOUTH AFRICA,
Department of Water Affairs, Pretoria (South Africa).

Group 8A—Structures

K. Merensky, and D. Hopkins.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY11, Proceedings paper 14992, p 1415-1432, November 1979. 14 Fig, 8 Ref, 1 Append.

Descriptors: *Dams, *Gate control, *Water levels, *Automation, Control, Flood control, Discharge(Water), Water level fluctuations, Maximum probable flood, Gates, Control structures, Control systems, Flood routing, Reservoirs, Reservoir operation, *South Africa.

The principle of proprtional, integral, and derivative sensing constituted the therme of this paper. A study was made of the different types of control elements involved. This resulted in the selection of a PID-controller as the most suitable. This controller was designed and installed, and three different methods were employed for determining the optimum parameter settings. These comprise direct calculation, analog computer simulation, and actual practical tests on site. The final parameter settings resulted in efficient and effective automatic water-level cntrol to within a spectrum of 1.18 in. - 1.57 in. at full supply level at incoming flows and floods ranging from 285 cfs-25,000 cfs (8 cu m/s-700 cu m/s). These results were due to the mechanism actually reacting to a water-level change of as small as 1 mm. (Sims-ISWS)
W80-02341

8B. Hydraulics

EFFECTIVENESS OF VARIOUS SAND AND GRAVEL SEPARATES FOR DRAIN ENVELOPES,
California Univ., Davis. Water Science and Engineering Section.
J. N. Luthin.
In: 'Factors Influencing Water and Particle Movement Into Drains,' Agricultural Research (Western Region), Science and Education Administration, U.S. Dept. of Agriculture, ARR-W-8, p 33-42, June 1979, 1 Fig, 4 Tab, (California Water Resources Center Project UCAL-WRC-W-212), OWRT-A-031-Cal(4).

Descriptors: *Drainage engineering, *Sands, *Gravels, *Well filters, Wells, Subsurface drainage, Drainage, Particle size, Tile drainage.

This study tested the effectiveness of various sand and travel separates in gravel envelopes. Some design criteria that governmental agencies use for drain envelopes were developed for gravel packs around wells. Although flow around a well is similar to that around a drain, flow is much faster near a well, and the lower amount of gravel required allows the use of a more expensive type of gravel envelope. The carefully graded envelope that is possible around a well is too expensive for an on-farm drainage system. The study reported here tested various envelope materials under conditions simulating those in the vicinity of a subsurface drain line, such as a tile drain. (Snyder-California)
W80-02076

PLANE TURBULENT WALL WAKES,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and S. P. Rai.
Journal of the Engineering Mechanics Division, American Society of Civil Engineers, Vol 105, No EM5, Proceedings Paper 14882, p 779-794, October 1979. 10 Fig, 1 Tab, 16 Ref, 2 Append.

Descriptors: *Boundary layers, *Fluid mechanics, *Walls, Hydraulics, Shear stress, Turbulent flow, Distribution, Velocity, Equations, Mathematical studies, Mathematics, Model studies, *Wakes, Velocity profile, Two-layer fluid model, Wind tunnel, Wall shear.

This paper presented a two-layer model to describe the velocity profiles in the far-wake region of plane turbulent wall wakes. In the outer region, the velocity profiles were described by the (simple) wake equation, whereas in the inner (wall) region, the law of the wall applies. Using the similarity property of the velocity profiles, the integral momentum equation, and the experimental results generated from a wind-tunnel study, equations have been developed to predict the velocity and length scales. The wall shear stress was found to be approximately constant in a large part of the far-wake region. (Lee-ISWS)
W80-02187

FLOW FIELD AND SCOURING EFFECTS OF STEADY AND PULSATING JETS IMPINGING ON A MOVABLE BED,
Stuttgart Univ. (Germany, F.R.). Inst. fuer Wasserbau.
For primary bibliographic entry see Field 2J.
W80-02188

FLOW SEPARATION UNDER HYDRAULIC JUMP,
Toronto Univ., (Ontario). Dept. of Mechanical Engineering.
H. J. Leutheusser, and S. Alemu.
Journal of Hydraulic Research, Vol 17, No 3, p 193-206, 1979. 9 Fig, 2 Tab, 11 Ref.

Descriptors: *Hyraulic jump, *Laboratory tests, *Model studies, *Flow characteristics, Flow separation, Hydraulic models, Measurement, Flow, Hydraulics, Analysis, Transition flow, Undeveloped flow, Fully developed flow.

Experiments were described in which the occurrence of flow separation under hydraulic jumps was studied as a function of Froude number, Reynolds number, and condition of inflow. The investigation was carried out in the 11 m long and 0.6 m deep test section of a horizontal, 15 m long, and 0.4 m wide open-channel flume. The floor of the flume has a smooth enamel finish, and the side walls are composed of plate-glass panels. The flume is equipped with an adjustable tail gate located, respectively, upstream and downstream of the test section. It was found that separation occurs quite generally, that it extends beyond the conventional downstream end point of the hydraulic jump, and that its severity tends to increase with increasing Froude number and to decrease with increasing Reynolds number. In any case, however, the areal extent and thickness of the separation cavity is very much larger for jumps with undeveloped inflow than it is for their counterparts with fully developed inflow. (Humphreys-ISWS)
W80-02189

WAVE DIFFRACTION BY ABSORBING WEDGE,
Math-Tech Inst., Charlottenlund (Denmark).
For primary bibliographic entry see Field 2L.
W80-02335

WAVE FORCES ON PARTIALLY SUBMERGED CYLINDERS,
Salford Univ., (England). Dept. of Civil Engineering.
A. G. Dixon, C. A. Greated, and S. H. Salter.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 105, No WW4, Proceedings Paper 14996, p 421-438, November 1979. 11 Fig, 2 Tab, 21 Ref, 2 Append.

Descriptors: *Waves(Water), *Energy, *Loads(Forces), *Model studies, Mathematical models, Hydraulic models, Laboratory tests, Buoyancy, Pressure, Drag, Oceans, Ocean waves, Coastal engineering, Hydraulics, *Cylinders.

Morison's equation for wave force was adapted to predict the force exerted by regular waves on a partially submerged horizontal cylinder. In particular, the vertical force equation was modified by introducing a buoyancy term and a varying volume after first discarding the drag term. Some experimental data taken in a 30-cm wide tank were used to calculate a value of the inertial coefficient C sub M using a least squares fitting procedure. Although a spread was found in the values of C sub M, it was suggested that the theoretical value for a submerged cylinder, C sub M = 2, could be used with some success. (Sim-ISWS)
W80-02336

MIXING OF BUOYANT SURFACE JET OVER SLOPING BOTTOM,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02338

TWO-DIMENSIONAL BUOYANT JETS IN STRATIFIED FLUID,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02343

MULTIPLE JETS IN SHALLOW FLOWING RECEIVING WATERS,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-02344

8E. Rock Mechanics and Geology

EFFECTIVENESS OF VARIOUS SAND AND GRAVEL SEPARATES FOR DRAIN ENVELOPES,
California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 8B.
W80-02076

GEOTHERMAL RESOURCES - WHAT TO LOOK FOR IN ARIZONA,
Arizona State Bureau of Geology and Mineral Technology.
N. O. Jones.
Fieldnotes, Vol 9, No 3, p 12-13, Sept, 1979. 4 Fig, 4 Ref.

Descriptors: *Geomorphology, *Geothermal studies, *Thermal properties, *Thermal water, Hydrogeology, Structural geology, Geologic formations, Geological surveys, Geochemistry, Geophysical factors, Arizona.

Over the past two years, the Arizona Bureau of Geology and Mineral Technology has conducted studies to establish the geological setting of the state's potential geothermal sites, and the surface, chemical, and geophysical characteristics indicative of Arizona's potential geothermal resources are reviewed here. The Bureau has determined from testing existing wells and drilling exploratory holes to ascertain volume/temperature that there are seven wells in Arizona with temperatures of over 100C. Although no electricity can be produced at these lower temperatures, several possible applications of this new source of energy are already being tried in Arizona including the drying of farm products and organic materials, evaporation in sugar refining, space heating, refrigeration, mushroom growing, soil warming, heating swimming pools, de-icing, the hatching of fish and others. The potential uses of geothermal resources are limited, it is concluded, only by the imagination of those who wish to put it to work. (Tickes-Arizona)
W80-02203

8I. Fisheries Engineering

PREFERRED STREAM DISCHARGES FOR SALMON SPAWNING AND REARING IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
C. H. Swift, III.
Geological Survey open-file report 77-422, 1979. 51 p, 14 Fig, 11 Tab, 6 Ref.

Descriptors: *Fish reproduction, *Salmon, *Spawning, *Washington, *Streams, Analytical

techniques, Streamflow, Flow rates, Drainage area, Channel morphology, Depth, Water levels, Equations, Fish migration, Fish populations.

Stream discharges preferred by salmon for spawning were determined from relationships between discharge and spawnable area at 84 study reaches on 28 streams in Washington. Preferred discharges for spawning were found statistically equivalent for chinook, pink, and chum salmon. Regression equations developed for estimating discharges preferred by these species for spawning at other stream sites had standard errors of estimate of 40 percent where a relationship with toe-of-bank channel width was used, and 55 percent where basin drainage area was used. Similarly, equations for estimating the preferred discharge for spawning by sockeye and coho salmon (also statistically equivalent) had standard errors of 48 percent using channel width and 61 percent using drainage area. In general, the discharges preferred for spawning by salmon ranged in magnitude from about 0.3 to 11 times the median monthly mean discharges for September and October and about 0.1 to 6 times the median monthly means for November and December--the four months when spawning is greatest. Stream discharges preferred by salmon for rearing were determined from relationships between discharge and wetted perimeter at the study reaches. Those discharges ranged from about 0.7 to 4 times the median monthly mean discharge for September, when low flows are usually most limiting on the rearing capacity of streams. Equations developed for estimating preferred rearing discharges at other stream sites had standard errors of 57 percent using channel width and 81 percent using drainage area. (Woodard-USGS).
W80-02243

OLFACTORY BULBAR ELECTRICAL RESPONSES OF RAINBOW TROUT (SALMO GAIRDNERI) EXPOSED TO MORPHOLINE DURING SMOLTIFICATION,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
T. J. Hara, and S. B. Brown.
Journal of the Fisheries Research Board of Canada, Vol 36, p 1186-1190, 1979. 5 Fig, 25 Ref.

Descriptors: *Fish behavior, *Toxicity, *Organic compounds, Fish migration, Rainbow trout, Growth stages, Fish physiology, Chemical properties, Mode of action, Biochemistry, Water pollution effects, *Morpholine.

Exposure of rainbow trut to M.00005 mg/L) morpholine during smolting period did not influence the subsequent neural response to this substance, when tested immediately and 12 mo after smolting. No significant difference in the morpholine-induced responses was obtained between the exposed and unexposed fish. Using N-ethylmaleimide, a sulfhydryl reagent, it was further confirmed that the morpholine-effect is caused by a mechanism not directly associated with the normal olfactory function. Perfusion of the olfactory organs with 0.1M morpholine for 10 min irreversibly inhibited the olfactory responsiveness to odorants. Sensitization of the olfactory bulbar electrical response is discussed in connection with homing of morpholine-imprinted salmonid fishes. (Deal-EIS)
W80-02392

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WATER-RESOURCES DATA INDEX FOR OSCEOLA NATIONAL FOREST, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. R. Seaber, and R. W. Hull.
Geological Survey open-file report 79-984, 1979. 42 p, 6 Fig, 9 Tab, 117 Ref.

Descriptors: *Hydrologic data, *Indexing, *Information retrieval, *Publications, Surface waters, Groundwater, Water quality, Phosphates, Mining, Climatic data, Meteorological data, Aquifers, Water levels, Test wells, Hydrogeology, Data storage and retrieval, Reviews, Florida, *Osceola National Forest(Fla).

The U.S. Geological Survey conducted an intensive investigation from December 1975 to December 1977 of the geohydrology of Osceola National Forest, Fla. The primary purpose was to provide the geohydrological understanding needed to predict the impact of potential phosphate industry operations in the forest on the natural hydrologic system. The investigation involved test drilling, implementation of a hydrologic monitoring network, water-quality sampling, comprehensive aquifer tests, and literature study. This report is an index to the type, source, location, and availability of the data used in the interpretive investigation. The indexes include: geological, geophysical, ground water, surface water, quality of water, meteorological, climatological, aquifer tests, maps, photographs, elevations, and reference publications. The manner of storage and retrieval of the data is decribed also. (Woodard-USGS).
W80-02240

SUBJECT INDEX

ABLATION
Water Yield Increases Through Surface Dusting of a Permanent Icefield,
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Geothermal Space Heating/Cooling--A Direct Use of Naturally Occurring Hot Water in Southern Arizona,
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Heavy Metals in the Sea-Skater Halobates Robustus from the Galapagos Islands: Concentrations in Nature and Uptake Experiments, with Special Reference to Cadmium,
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The Occurrence of Copper, Iron and Zinc in the Hard Shell Clam, Mercenaria Mercenaria, and Sediments of Southampton Water,
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Lead in Spotted Wolfish, Anarhichas Minor, Near a Zinc-Lead Mine in Greenland,
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Evidence of Acidification of Headwater Streams in the New Jersey Pinelands,
W80-02190 5B

ADAPTATION
Responses to Salinity in Larvae from Three Local Populations of the Freshwater Shrimp, Macrobrachium Nipponense,
W80-02216 5A

ADJUSTED COSTS
Optimal Pollution in the Presence of Adjustment Costs,
W80-02133 6C

ADRIATIC SEA
Zooplankton Communities of the NW Adriatic Inshore Waters Near Dubrovnik,
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Municipal Recycling of Wastewater,
W80-02044 5D

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Wastewater Management Alternatives for the Cleveland-Akron, Three Rivers Watershed Area: Technical Appendix-Phase I: Municipal Wastewater and Stormwater Runoff.
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AGRICULTURE
Wastewater Management Study for Cleveland-Akron Metropolitan and Three Rivers Watershed Areas. IX: Agricultural Evaluation.
W80-02041 5D

Critical Factors in the Transport of Live Freshwater Fish--II. State of Feeding and Ammonia Excretion,
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AIR POLLUTION EFFECTS
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AKRON (OH)
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W80-02037 5D

Wastewater Management Study for Cleveland-Akron Metropolitan and Three Rivers Watershed Areas, Appendix II: Comments.
W80-02038 5F

Wastewater Management Study for Cleveland-Akron Metropolitan and Three Rivers Watershed Areas, Appendix III: Municipal Wastewater and Stormwater Runoff.
W80-02039 5D

Wastewater, Management Study, for Cleveland-Akron Metropolitan and Three Rivers Watershed Areas, Appendix VII: Institutional Evaluation.
W80-02040 5D

Wastewater Management Study for Cleveland-Akron Metropolitan and Three Rivers Watershed Areas. IX: Agricultural Evaluation.
W80-02041 5D

Wastewater Management Alternatives for the Cleveland-Akron, Three Rivers Watershed Area: Technical Appendix-Phase I: Municipal Wastewater and Stormwater Runoff.
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Reconstructed Pleistocene Ice-Sheet Temperatures and Glacial Erosion in Northern Scotland,
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Transport and Transformations of Anthracene in Natural Waters,
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W80-02286 7C
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W80-02294 7A
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W80-02395	5A
W80-02396	5A
W80-02397	5A
W80-02398	5B
W80-02399	5A
W80-02400	2A

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Illinois State Water Survey, Hydrology	W80-02050, 02147 02161--02193 02220, 02224 02309, 02326 02332--02366 02400	75
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B. STATE WATER RESOURCES RESEARCH INSTITUTES	W80-02051--02052 02076--02077 02151--02154 02156--02159 02194--02195	14
C. OTHER		

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SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W80-02078--02079 02081--02082 02084--02088 02090--02126 02150 02211--02219 02221--02223 02225--02229 02250--02251 02368--02399	98
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